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ERADICATE COMMON BARBERRY

LESSON PLAN\*

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Teacher's Aim

To familiarize students with the role of common barberry in the spread of black stem rust, and to teach them how to identify the bush.

Pupil's Aim

To learn the objects of the barberry eradication campaign with the view of aiding in the eradication of all common barberry in his neighborhood.

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Reference Material

1. Minnesota Bulletin No. 55 - Barberry Eradication Pays.
2. U.S.D.A Circular 356 - The Common Barberry and How to Kill It.
3. Plate I - The life cycle of stem rust.
4. Plate II - Know the barberry bush.
5. Mounted samples of common barberry.

Suggestions for the Teachers

1. The enclosed questions are designed to cover the essential points on the purpose of the barberry eradication campaign.
2. The teacher may give the pupils questions and the answers for study and then ask the questions in class, or take them up with the school as a whole, as a part of general nature study.
3. The study also may be included in language, arithmetic, and spelling classes.
4. A practical application of this lesson plan should be made by asking the pupils to look for common barberry, and to bring to the teacher a small branch of any bush which they believe to be barberry. These branches can be studied to determine if their characters agree with the description of common barberry. If there is doubt, send them to the Barberry Office, University Farm, St. Paul, Minnesota. If actual samples of common barberry are brought to the teachers, a branch should be sent and the location reported to the above office. The barberry bushes will be eradicated by barberry field men.

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\*The first part of this lesson plan is a revision of the South Dakota lesson plan by R. O. Bulger, and a plan by N. F. Thompson and D. G. Fletcher

Suggested Questions and Answers

Question 1. What causes black stem rust?

Answer - Black stem rust is a disease of cereals and grasses caused by a fungus. (Bul. 55, page 4.)

Q. 2. What kinds of grain does black stem rust attack?

A. - Wheat, barley, rye, and oats. (Bul. 55, page 16.)

Q. 3. How much damage does stem rust cause to wheat each year in Minnesota?

A. - Between three and five million dollars. (Bul. 55, pages 3 & 22.)

Q. 4. Name the different stages of the life cycle of stem rust.

A. - Black or winter stage. 2. Yellow, spring, or cluster-cup stage.  
3. The red or summer stage.

Note: On germination, each black spore sends out two germ tubes, on each of which four small colorless, early-spring spores are formed. These spores are very small and are easily blown about by the wind. These colorless spores are often called the "colorless spore stage," making four instead of three stages in the life cycle of stem rust.

Q. 5. What stage occurs on the common barberry? When does it occur?

A. - The spring or cluster-cup stage occurs on common barberry in May, June, and early July. (Bul. 55, pages 4 & 5.)

Q. 6. What stages of stem rust are found on grains and grasses?

A. - The red or summer stage and the black or winter stage. (Bul. 55, pages 4, 5, & 6.)

Q. 7. How is stem rust spread from the common barberry?

A. - The yellow spots which form on the leaves of the barberry in May and June contain many little cup-shaped growths. Each of these cups contain thousands of spores. These spores are shot out of the cups and are blown to grains and grasses. (Bul. 55, pages 7 & 8.)

Q. 8. How far does stem rust spread from barberries?

A. - The spread of stem rust from common barberry has been traced for over ten miles in Minnesota. It is probable that rust is spread farther than that from common barberry. (Bul. 55, pages 7, 8, & 9.)

Q. 9. How is the rust spread from field to field?

A. - Within a week to ten days after the cluster-cup spores from the barberry have fallen on susceptible grains or grasses, pustules filled with the spores of the red or summer stage of the rust appear. These spores are blown about by the wind to other grains or grasses where they cause rust. In hot weather this occurs every six days. (Bul. 55, pages 5 & 6.)



Q. 10. What effect does hot, muggy weather have on stem rust?

A. - In cool, dry weather, it takes ten days or longer for a crop of spores to develop after infection has taken place. In hot, muggy weather pustules containing spores may develop in six days. (Bul. 55, page 15.)

Q. 11. What role does wild grasses play in the spread of stem rust?

A. - Often, there are no grain fields near common barberry, but the rust is spread to wild grasses and thence to grain fields. (Bul. 55, page 6.)

Q. 12. How high in the air have rust spores been found?

A. - 7,500 feet. (Bul. 55, page 6.)

Q. 13. Would the eradication of all common barberries on one farm protect the grain on that farm from black stem rust?

A. - No. Stem rust can be blown from more distant barberries and infect the grain on this farm. (Bul. 55, pages 6, 7, & 8.)

Q. 14. How does rust live through the winter?

A. - Rust lives through the winter in the black stage which is on straw, stubble, and wild grasses. It can not live through the winter in the soil or seed. (Bul. 55, pages 4, 6, & 14.)

Q. 15. Do the red or summer spores live through the winter in Minnesota?

A. - No. (Bul. 55, page 6.)

Q. 16. Can black spores cause infection on other grains directly?

A. - No. A black spore must first germinate and form the colorless spring spores which are blown to and infect the barberry. The rust from the barberry is then blown to grasses and grains. Black spores blown to grains and grasses can not cause infection. (Bul. 55, page 6.)

Q. 17. What is the color of the stem rust spores produced on the grain plants after they are infected by the rust spores from the barberry?

A. - Red. (Bul. 55, page 6.)

Q. 18. What is the color of the stem rust spores produced on the grain when it ripens?

A. - Black. (Bul. 55, page 6.)

Q. 19. Are there other kinds of rust which attack grains?

A. - Yes. Leaf rusts attack wheat, barley, rye, and oats. (Bul. 55, page 16.)

Q. 20. What is common barberry? How is it identified?

A. - A bush. A common barberry has spiny-edged leaves; 3 to 5 spines in a group on the stem; oval berries borne in bunches like currants; gray, furrowed bark, and yellow inner bark. (Bul. 55, pages 19 & 20.)

Q. 21. What species of barberry is harmless? How is it distinguished from common barberry?

A. - Japanese barberry. The Japanese barberry is distinguished from the common barberry by having smooth-edged leaves; spines borne singly; oval-shaped berries borne like gooseberries; and reddish brown bark. (Bul. 55, pages 19 & 20.)

Q. 22. How should common barberry bushes be killed?

A. - With salt or kerosene.

Q. 23. Should barberberries be dug?

A. - No. It is difficult to get all the roots, and those which remain sprout vigorously and again develop into bushes. (Bul. 55, page 20.)

Q. 24. What are barberry sprouts?

A. - Young bushes developed from fragments of roots left in the ground.

Q. 25. How does common barberry escape from cultivation?

A. - Birds and animals eat the fruit and spread the seeds to groves and woodlots where seedlings can develop. These seedlings soon grow into large bushes which bear seeds. (Bul. 55, pages 10, 11, & 12.)

Q. 26. Where are escaped barberry bushes found?

A. - In any place where any kind of a bush can grow: in groves, woodlots, hillsides, swamps, cliffs, etc. (Bul. 55, page 13.)

Q. 27. In what States is common barberry being eradicated?

A. - Montana, Wyoming, Colorado, North Dakota, South Dakota, Nebraska, Minnesota, Iowa, Wisconsin, Illinois, Indiana, Michigan, and Ohio.

Q. 28. What department of the Federal Government is in charge of the campaign?

A. - U. S. Department of Agriculture.

Q. 29. To what office should you report all common barberry bushes?

A. - Barberry Office, University Farm, St. Paul, Minnesota.

### Language

Write letters asking for bulletins on barberry eradication.

Write a letter to some farmer telling him about the relation of the common barberry to black stem rust.

Have the pupils write sentences containing the words suggested for a spelling lesson.

### Arithmetic

The following figures were obtained by actual counts made on a common barberry bush of medium size:

Total number of leaves .....	35,000
Percentage of leaves showing rust .....	80
Average number of rust clusters on each infected leaf .....	8
Average number of cups in each cluster .....	36
Average number of spores in one cup of a cluster .....	8,000

Compute the following for the above bush: Total number of leaves infected. Number of cluster cups. Number of individual cups. Number of spores.

#### Home Problem

If one spore from a barberry produced a pustule which contained 100,000 spores on a grain plant, how many spores would be produced at the end of 50 days if a new generation were produced every 10 days and every spore produced during the season caused infection on grain plants?

This would mean that if every one of the 100,000 spores caused infection and another crop of spores were produced in about 10 days, the number of spores would increase 100,000 times, or  $100,000 \text{ spores} \times 100,000 = 10,000,000,000$  spores. After another 10 days they would multiply 100,000 times more.

What would the number of spores be at the end of 20 days? 30 days? 40 days? 50 days?

#### Geography

Study the area in which the barberry eradication campaign is being carried on. Where is most of our spring wheat grown? Winter wheat? Give reasons for clearing this area of all common barberry bushes.

#### Spelling

The following common words are used repeatedly in the bulletins on this subject and may be used for a spelling lesson:

barberry	destructive	cooperation	chemical	germinating
eradication	disease	campaign	kerosene	common
destroys	epidemic	yield	average	European
stem rust	damage	weather	production	grain
spore	agriculture	reduced	escaped	sprouts
Japanese	cluster-cup	spine	prevention	resistant
harmless	pustule	berries	inoculum	wheat

#### Single Word Answer Test

Unit - Common barberry and black stem rust.

Directions: Write one word as an answer to each of the following questions.



1. What type of food plants does black stem rust attack? Ans. Grain.
2. How many kinds of grain are attacked? Ans. Four.
3. What stage of black stem rust lives through the winter? Ans. Black.
4. What stage of black stem rust occurs on the barberry? Ans. Cluster-cup.
5. In what month does common barberry start spreading stem rust? Ans. May.
6. What stage of stem rust spreads from field to field? Ans. Red (or summer).
7. What kind of barberry spreads stem rust? Ans. Common.
8. What is the nature of the edges of its leaves? Ans. Frickly-edged.
9. What kind of a plant is common barberry, -tree, shrub, or herb? Ans. Shrub.
10. What other kind of barberry is commonly grown? Ans. Japanese.
11. What common chemical is effective for killing common barberry? Ans. Salt
12. Should common barberry be dug when growing in woods? Ans. No.

### Completion Test

Unit - The relation of common barberry to black stem rust.

Directions: Fill in the missing word or words so as to complete the thought.

Black stem rust is a \_\_\_\_\_ of grains and grasses caused by a \_\_\_\_\_. It attacks \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, and \_\_\_\_\_ and many wild \_\_\_\_\_. It does damage to wheat in Minnesota each year estimated to be between \_\_\_\_\_ and \_\_\_\_\_ million dollars. Stem rust has a definite life cycle which is divided in three stages, namely: 1, \_\_\_\_\_ stage; 2, \_\_\_\_\_ stage; 3, \_\_\_\_\_ stage. The \_\_\_\_\_ stage occurs on common barberry in \_\_\_\_\_, \_\_\_\_\_, and early \_\_\_\_\_. In these months there are yellow spots which contain many little cup-shaped growths, each one of which contains thousands of spores (similar to \_\_\_\_\_ but much smaller), which are \_\_\_\_\_ out and \_\_\_\_\_ to grains and \_\_\_\_\_. Stem rust spreads from \_\_\_\_\_ to \_\_\_\_\_ has been traced for over \_\_\_\_\_ miles in Minnesota. In cool, dry weather it takes \_\_\_\_\_ days or longer for a crop of spores to develop after infection. In hot, muggy weather pustules or spots containing \_\_\_\_\_ develop in only \_\_\_\_\_ days. Often there are no grain fields near common barberry, but the rust is spread to \_\_\_\_\_ and thence to grain fields. Stem rust spores have been found \_\_\_\_\_ feet up in the air. The stem rust organism lives over \_\_\_\_\_ in the black stage which is found on \_\_\_\_\_, \_\_\_\_\_, and wild grasses. It can not live over winter in the soil or seed. Red or \_\_\_\_\_ spores can not live through the winter in Minnesota. Black spores can not cause infection of grains directly.

Common barberry is a \_\_\_\_\_ and is identified by having \_\_\_\_\_ edged leaves, \_\_\_\_\_ to \_\_\_\_\_ spines in a group on the stem, oval berries borne in bunches, like \_\_\_\_\_, \_\_\_\_\_ bark which is \_\_\_\_\_ on the inside next to the wood. Japanese barberry is distinguished from the common barberry by having \_\_\_\_\_ edged leaves, spines born \_\_\_\_\_, oval shaped berries born like \_\_\_\_\_, and \_\_\_\_\_ bark.

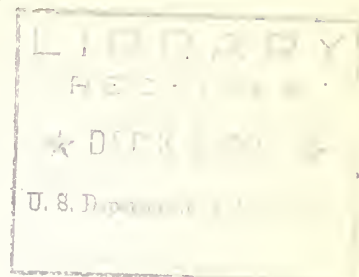
The best way to kill common barberry is to apply \_\_\_\_\_ at the \_\_\_\_\_ of the bush. Digging bushes is unsafe because fragments of \_\_\_\_\_ left in the soil will \_\_\_\_\_ vigorously.

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A LESSON PLAN BY WHICH IOWA TEACHERS MAY PRESENT THE SUBJECT  
"BLACK STEM RUST AND THE COMMON BARBERRY."

STATE OF IOWA  
DEPARTMENT OF PUBLIC INSTRUCTION

Agnes Samuelson, Superintendent  
Fred L. Mahannah, Deputy  
Des Moines



To Iowa Superintendents,  
Principals and Teachers:

The eradication of the common barberry which is largely responsible for the spread of black rust of small grains, is being brought to your attention by the United States Department of Agriculture. The facts relative to the barberry problem and its solution are definitely set forth in the Farmers' Bulletin No. 1058 entitled, "Destroy the Common Barberry."

The story of the common barberry and its relation to the black stem rust will interest the school children so much that they will wish to learn the identification and destruction of this bush. Some splendid material giving information on this subject is being sent the schools by the Department of Agriculture. We urge your use of this literature for lessons in Citizenship and Agriculture.

Your co-operation in this undertaking will contribute towards reaching the big objective of our government--the reduction of the yearly grain and money loss caused by the common barberry. At the same time some valuable outcomes in citizenship and other school subjects are possible from the use of the material.

Very sincerely yours,

AGNES SAMUELSON,

Superintendent of  
Public Instruction, Iowa.

Furnished to the schools of Iowa by the Office of Cereal Crops and Diseases, Bureau of Plant Industry, United States Department of Agriculture, in cooperation with the State Agricultural College, Ames, Iowa, the Conference for the Prevention of Grain Rust, 300 Lewis Building, Minneapolis, Minnesota, and the State Department of Public Instruction, Des Moines, Iowa.

The following lesson plan has as its basis a lesson plan for North Dakota schools prepared by George C. Mayoue<sup>1</sup> and a general lesson plan prepared by Donald G. Fletcher<sup>2</sup> and Noel F. Thompson<sup>3</sup>. It has been adapted to meet the needs of Iowa schools by P. W. Rohrbaugh<sup>4</sup>.

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3. Associate Pathologist, Office of Cereal Crops and Diseases, Bureau of Plant Industry, U. S. Department of Agriculture.
4. State Leader of Barberry Eradication in Iowa.



## LESSON PLAN

A plan by which the teachers of Iowa may be guided in presenting the essential facts concerning stem rust and its prevention through the eradication of the common barberry.

### Teacher's Aim:

(1) To become familiar with the common barberry and its relation to black stem rust, and (2) to impart this information to the students.

### Student's Aim:

(1) To learn the essential facts concerning the life history and the importance of black stem rust: (2) To learn to recognize the common barberry and distinguish it from other shrubs, including the Japanese barberry; (3) To learn to recognize the four stages of stem rust: and (4) To disseminate this information in the community.

## POSSIBLE CORRELATIONS

The study of the common barberry may be advantageously included in the study of any or all of the following subjects: Botany, Biology, Agriculture, General Science, Nature Study, Language, Arithmetic, Geography, and Spelling.

## DEFINITIONS

Before beginning the study of black stem rust the following definitions should be mastered:

**PARASITE:** A living organism, either an animal or a plant, that lives on or in some other organism from which it derives its nourishment for the whole or a part of its existence. It produces no food of its own. A plant parasite then, is a plant which steals its food from another living plant. Much such parasites are fungi, but not every fungus is a parasite, as some are called saprophytes because they live on dead material.

**FUNGUS:** A fungus is a plant devoid of green coloring matter. Unlike green plants, it does not produce its own food materials, but obtains them from living or dead organic matter. It reproduces usually by means of spores. Examples of fungi: Toadstools, puffballs, bread molds, smuts, rusts, etc.

**SPORE:** A spore is a minute reproductive body or cell. It might very well be called the seed of a fungus.

**HOST or HOST PLANT:** Host plant is a term applied to the plant on or in which a parasite lives and from which it gets its food.

LIFE CYCLE: The life cycle of a plant or animal is the series of stages through which it passes before completing its full development.

Examples: An example of this can be found in the four stages of the life cycle of the butterfly. First, the egg, then the worm, next, the pupa, and finally the butterfly. Black stem rust furnishes one of the best examples of the life cycle of a parasitic fungus.

### SOURCES OF INFORMATION

United States Department of Agriculture Farmers' Bulletin 1058, Department Circulars 269 and 356, and Iowa Extension Bulletin 141. Pamphlets prepared by the Conference for the Prevention of Grain Rust, 300 Lewis Building, Minneapolis, Minnesota an agency cooperating with the United States Department of Agriculture and the States.

### SUGGESTIONS TO THE TEACHER

The loss of grain in the principal grain-growing areas of the United States from black stem rust has increased greatly in the last fifty years somewhat in proportion to the number of common barberry bushes. These bushes were introduced and planted as shrubbery and hedges, but their seeds have been scattered by birds and cattle to waste lands and wooded areas. Almost every farmer who has raised grain has suffered losses from black stem rust. Effective control of this disease is of vital interest to American agriculture. It is of especial importance in Iowa, where so much oats, barley, and wheat are grown.

Small grains are attacked also by several other plant diseases which in some sections cause severe damage. The diseases most easily confused with stem rust are the leaf rusts of cereals, including crown rust of oats. Where the leaf rusts occur, pupils should be taught to distinguish between the leaf rusts and black stem rust, which is the only grain rust spread by the common barberry.

Read the bulletins carefully. Familiarize yourself with the answers to the questions. Allow the pupils to study the material, the bulletins, and the charts, before beginning any discussion on the subject. Divide the study questions into several recitation periods as thought best. Emphasize the identification of the common barberry bush. Have the pupils bring to school samples of any bushes they may believe to be the common barberry, and, if necessary, send the samples to the Barberry Eradication Office, Iowa State College, Ames, Iowa, for identification. Encourage the pupils to ask their parents about black stem rust and the damage it does. Explain carefully the relation of the common barberry to this rust. Point out clearly that the destruction of every common barberry is absolutely necessary for the successful control of black stem rust. Encourage the pupils to look for barberry bushes. When one is found, let all the neighbors see it, then report its location to the Barberry Eradication Office, Iowa State College, Ames, Iowa.

## A. RELATION OF COMMON BARBERRY TO BLACK STEM RUST

Question 1. What is black stem rust?

Answer - Black stem rust is a fungus parasite which attacks wheat, barley, oats, rye, and many of the tame and wild grasses.

Reference - Iowa Extension Bulletin 141, p. 2; U. S. Department of Agriculture Farmers' Bulletin 1058, pp. 5 & 6; Department Circular 269, p. 12; Department Circular 356, p. 1.

A. - The rust attacks the grain plant and robs it of the food

Q. 2. Explain why and how the kernels are shriveled when rust attacks the plant severely.

which is intended for the development of the kernels. As a result these kernels are undernourished, and shriveled from lack of food.

Ref. - Iowa Extension Bulletin 141, p. 2.

Q. 3. Name the four stages in the life cycle of stem rust.

A. - The four stages of black stem rust are:

- (1) The yellow, cluster-cup, or spring-spore stage. Develops only on the barberry bush. Produces yellow spores.
- (2) The red, or summer-spore, stage. Develops only on grains and grasses. Its reddish-brown spores spread to other grains and grasses and produce a second crop. In like manner, successive crops of summer spores develop about every ten days throughout the summer.
- (3) The black, or winter-spore, stage. Develops only on grains and grasses. Follows the summer stage, producing its black spores in the red-spore pustules or in new pustules.
- (4) The colorless-spore stage. Produced in the early spring by germinating black spores. These colorless spores infect only the barberry, producing the cluster-cup stage.

Ref. - Iowa Extension Bulletin 141, p. 4; Farmers' Bulletin 1058, pp. 5 & 6; Department Circular 269, p. 12; Department Circular 356, p. 2.

Q. 4. Why will the eradication of the common barberry in Iowa and adjacent States tend to stop destructive stem-rust epidemics?

A. - Without the common barberry, the black-spore stage which lives over the winter can not infect grains and grasses. The red stage, which can infect grain directly, does not live over winter in these States.

Ref. - Iowa Extension Bulletin 141, p. 2.

Q. 5. What effect does hot, wet weather have on black stem rust?

A. - Hot, wet weather speeds up the production of rust spores. which enables the rust to spread rapidly.



Q. 6. What color is the rust produced on a grain plant after it becomes infected by the spores from a rusted barberry bush?

A. - The first stage of the rust which appears on grain plants is brick red.

Ref. - Iowa Extension Bulletin 141, p. 3.

Q. 7. How is rust spread from the barberry to grains and grasses?

A. - The rust is spread from the barberry to grains and grasses by tiny spores carried by the wind. These spores are so small that they can not be seen with the naked eye.

Ref. - Iowa Extension Bulletin 141, p. 3.

Q. 8. Can this red rust on the grain plants infect other grain plants? Does stem rust produce one crop or more than one crop of red spores during the summer? How often may a new crop of red spores be produced if weather conditions are favorable?

A. - Yes, the red rust on the grain plants can infect other grain plants by means of the red spores. Stem rust may produce a number of crops of red spores during the summer, the number depending on weather conditions. Under favorable weather conditions a new crop of red spores may be produced every seven to ten days. Each new spore may infect another plant and thus aid in the spread of rust.

Ref. - Iowa Extension Bulletin 141, p. 7.

Q. 9. Can black spores directly infect grains and grasses?

A. - No, black spores can not directly infect grains, they are the resting spores by which the rust survives the winter.

Ref. - Iowa Extension Bulletin 141, p. 7; Farmers' Bulletin 1058, p. 6.

Q. 10. Can the black spores directly infect the barberry?

A. - No, the black spores germinate and produce the colorless spores which infect the common barberry.

Ref. - Department Circular 356, p. 2.

Q. 11. What are the only plants that can be infected by the colorless spores of black stem rust?

A. - Only some plants belonging to the barberry family.

Ref. - Iowa Extension Bulletin 141, p. 7; Farmers' Bulletin 1058, pp. 5 & 6.

Q. 12. Do all kinds of barberries spread black rust?

A. - No. The Japanese barberry does not spread stem rust.

Ref. - Iowa Extension Bulletin 141, p. 8.

Q. 13. What is one of the best methods of controlling black stem rust?

A. - The eradication of the common barberry is one of the best methods of controlling stem rust in both the northern United States and many foreign countries, because the red spores do not live through the winter in the Northern States, and because the black spores and the colorless spores are harmless without the barberry.

Ref. - Iowa Extension Bulletin 141, p. 2; Farmers' Bulletin 1058, pp. 5, 6, & 7; Department Circular 269.

Q. 14. Would the eradication of all the common barberries on one farm protect the grain on that farm from black stem rust?

A. - No; because spores of stem rust may be blown from barberries or rusted grain on other farms. Rust spores, being very small, may be carried by the slightest breeze.

Ref. - General information from all bulletins.

Q. 15. Could the barberries in the neighboring States produce rust which might spread to the grain in this State?

A. - Yes, under favorable weather conditions it is very likely that spores from barberry bushes in one State could be blown into another State and cause rust infections.

Q. 16. What have other countries done to control black stem rust?

A. - Several foreign countries, notably Denmark, have passed laws compelling the destruction of the common barberry. In each of these countries serious damage from black stem rust no longer occurs.

#### B. LOSSES CAUSED BY BLACK STEM RUST

Q. 1. Why is the market value of shriveled grain greatly reduced? (Compare a sample of rust-shriveled grain with a sample of plump grain which has not been damaged by rust.)

A. - Shriveled grain is not as heavy as the plump grain, and its value is also reduced by the fact that it is not well suited for milling purposes.

Go to your local elevator and inquire the market price of wheat weighing 58 pounds to the bushel and wheat weighing 48 pounds to the bushel (Wheat that has been attacked by rust very often weighs ten or more pounds less than wheat which has been free from rust and other diseases.)

Q. 2. What is the average annual stem-rust loss in the United States? In Iowa?

A. - The average stem-rust loss to small grains in the United States is estimated at nearly 50,000,000 bushels annually for the 12-year period 1915 to 1926, inclusive. In Iowa alone in the same period the average annual loss is estimated at about 3,510,300 bushels.

Ref. - Iowa Extension Bulletin 141, p. 2

Q. 3. Has barberry eradication reduced stem-rust losses in the barberry eradication area?

A. - Yes. Although the campaign to remove all of the barberries is far from completed, stem-rust epidemics have become less severe and the general annual occurrence of stem rust has been considerably later.

### C. IDENTIFICATION OF COMMON BARBERRY

Q. 1. Describe the appearance of the common barberry bush as to shape and size.

A. - The common barberry is an erect shrub of graceful habit. It ranges from a seedling bush of a few inches to a mature shrub of possibly twelve or more feet. The color of the leaves is a dull green. There also is a variety of the common barberry which has purple leaves.

Ref. - Iowa Extension Bulletin 141, p. 8; Department Circular 356, p. 2; Farmers' Bulletin 1058, pp. 9 & 10.

Q. 2. Describe the outer bark, inner bark, leaves, thorns, flowers, and berries of the common barberry.

A. - The outer bark is grayish in color and is furrowed; the inner bark is bright yellow. The leaves normally are produced in clusters. They always have bristle-toothed edges. The three-pointed thorns occur at the base of the leaf clusters. The flowers are yellow. The berries are green in the summer and red in the fall and winter. They are produced in drooping bunches like currants.

Ref. - Iowa Extension Bulletin 141, p. 8; Department Circular 356, p. 2.

Q. 3. Compare the bark, branches, leaves, flower clusters, and berries of the common barberry with those of the Japanese or harmless barberry.

A. - The bark of the common barberry is gray and furrowed, in comparison with the reddish-brown, smooth bark of the Japanese barberry. The branches of the common barberry grow erect, but those of the Japanese barberry are spreading, rarely attaining a height of over four feet. The leaves of the common barberry have bristle-toothed edges; those of the Japanese barberry have smooth edges. The thorns of the Japanese barberry usually occur singly at the base of the leaves. The flower clusters and the berries of the common barberry grow in bunches like currants, while on the Japanese barberry the flowers and berries appear singly or in pairs.

Ref. - Iowa Extension Bulletin 141, pp. 10 & 11; Department Circular 356, p. 3.

### D. OTHER METHODS OF BLACK STEM RUST CONTROL

Q. 1. What effect does the early planting of spring grain have on the control of stem rust?

A. - The early planting of spring grain may help it to mature earlier and thus escape the late epidemics of stem rust.



Q. 2. How can the farmer help the grain to get a good start so that it can ripen before the rust damages it?

A. - Proper crop rotation, proper fertilizers, thorough preparation of the seed bed, early seeding, and the use of early and best-adapted varieties of grain will aid in the production of a sturdy plant which is less likely to be attacked by rust than weaker plants.

Q. 3. Are there varieties of spring wheat that are more resistant to stem rust than others? What are they?

A. - Most of the varieties of red hard spring common wheat are more susceptible to black stem rust than are the durum wheats. Of the durums, Monad and Nodak are more resistant than Kubanka and Arnautka, the standard varieties. Of the common varieties, Kota and Ceres are more resistant to stem rust than Marquis, the most widely grown variety of spring wheat.

#### E. INTRODUCTION AND DISTRIBUTION OF THE COMMON BARBERRY IN THE UNITED STATES

Q. 1. Is the common barberry native to the United States?

A. - No.

Ref. - Iowa Extension Bulletin 141, p. 8.

Q. 2. Where did the common barberry come from, and how has it been distributed throughout the country?

A. - The common barberry is thought to be native to the mountains of middle and western Asia, where it was used by man as a medicinal plant. As civilization advanced, the bush was carried by either root or seed wherever the new settlers went. In addition to the use of its leaves and bark for medicinal purposes, the berries have been used in making jellies and wines, and the yellow roots were made into dyes. Later the shrub was used as a hedge fence and for ornamental purposes. For this latter use it was commercialized by nursery companies and sold throughout the United States.

Ref. - Iowa Extension Bulletin 141, p. 8.

Q. 3. Are there any harmful barberries native to North America?

A. - Yes, two species of harmful barberry have been found to be native to North America. Neither of these species is native to Iowa. One of the native species, called *BERBERIS CANADENSIS*, has been found in Illinois, Indiana, and Kentucky and in the Allegheny Mountains. The second species, *BERBERIS FENDLERI*, has been found in Colorado and other Rocky Mountain States.

Q. 4. By what means are the seeds of the common barberry scattered from a seed-bearing bush?

A. - The barberry seeds are scattered principally by birds. but also by cattle and other animals, by man, and by running water.

Ref. - Iowa Extension Bulletin 141, p. 9.

Q. 5. How long do barberry seeds lie in or on the ground before germinating? How does this increase the difficulty of barberry eradication?

A. - Barberry seeds have been known to lie in or on the ground for as long as six years before germinating. For this reason several reinspections of properties on which bushes have been destroyed are necessary.

#### F. ERADICATION OF THE COMMON BARBERRY

Q. 1. Does Iowa have a law condemning the common barberry?

A. - Yes. This law was passed in 1919. Similar laws are in force in each of the other States in the barberry eradication area.

Q. 2. How are common barberry bushes killed?

A. - Common barberry bushes may be killed by digging or by the application of salt or kerosene to the base of the bushes.

Ref. - Iowa Extension Bulletin 141, p. 13; Department Circular 356, p. 3.

Q. 3. Why is digging often unsatisfactory?

A. - Digging is unsatisfactory because a small root fragment left in the ground may produce sprouts which will spread stem rust.

Ref. - Iowa Extension Bulletin 141, p. 13; Department Circular 356, p. 3.

Q. 4. Why is it necessary to revisit properties even after the original barberry bushes have been removed?

A. - Because the seeds may lie in or on the ground for a period of several years before germinating, and also because bushes that have been dug very often produce sprouts.

Q. 5. Why must care be exercised in placing salt or kerosene on barberry bushes growing in a lawn?

A. - Salt or kerosene placed upon barberry bushes growing in a lawn or hedge also may kill valuable shrubbery or other vegetation within an area of five or six feet. For this reason care must be used in the application of these two chemicals.

Ref. - Iowa Extension Bulletin 141, p. 13; Department Circular 356, p. 4.

Q. 6. If you find a bush which you think is common barberry, to whom would you send a sample for definite identification?

A. - Samples of bushes suspected to be common barberry will be identified free of charge if they are mailed to the Pathology Department, Iowa State College, Ames, Iowa.

Q. 7. If you find a bush which you think is common barberry, should you destroy it?

A. - No one should destroy any shrubbery until the sample of it has been properly identified. In this way valuable hedges and shrubbery will not be destroyed by mistake.

### PRACTICAL EXERCISES

Ask the pupils to bring in some of the black stage of the rust which is present on the stubble of most grain fields. Examine the rusted straw under a hand lens or a microscope. Notice how the rust has broken through the straw. Scrape some of the black spores from the stem into a drop of water on a glass slide. Place a cover glass on the material and examine under the microscope. Note that the black spores are two-celled. Note their comparatively thick walls. Each cell of a black spore may germinate in the spring and produce the tiny colorless spores which infect the common barberry.

If the red or summer stage of the rust is available, prepare a microscope slide of it. Compare the size, shape, and color of these spores with the black spores. Note that the red spores are only one-celled and are oval in shape. Note, too, that the walls on the red spores are thin. It is for this reason that these spores soon dry out or are killed quickly by cold weather.

Have the pupils draw a twig of the common barberry showing the chief characteristics by which the bush may be identified.

Examine a group of cluster cups on a barberry leaf. An average-sized cluster-cup contains from 8,000 to 15,000 spores, so that a moderately-infected common barberry bush six feet high may produce hundreds of millions of black stem-rust spores.

A list of the farms in your county on which barberry bushes have been found will be furnished upon request.

A field trip may be made to one or more of these farms. Sprouts or small bushes from seeds which have been scattered may be found. This will furnish some idea of where the bushes may be expected.

See if you can locate any bushes, and be sure to report them to the Barberry Office at Ames.

## CORRELATIONS

### Language

Write a letter asking for bulletins on barberry eradication. Write a letter to some farmer telling him about the relation of the common barberry bush to black stem rust. Have the pupils write sentences containing the words suggested for a spelling lesson.

### Arithmetic

The following figures were obtained by actual counts made on a common barberry bush of medium size:

Total number of leaves - - - - -	35,000
Percentage of leaves showing rust - - - - -	80
Average number of rust clusters on each infected leaf	8
Average number of cups in each cluster - - - - -	36
Average number of spores in one cup of a cluster - -	11,500

Q. 1. How many rusted leaves would there be on the average-sized bush?

A. - 28,000.

Q. 2. How many clusters of cluster-cups would there be on the average-sized bush?

A. - 224,000.

Q. 3. How many cluster-cups would there be on each leaf?

A. - 288.

Q. 4. How many cluster-cups would there be on the entire bush?

A. - 8,064,000.

Q. 5. How many spores would be produced on the entire bush?

A. - 92,736,000,000.

Q. 6. If the wind distributed these spores so that one fell on each square inch of land surface, how many acres would the spores from this bush cover?

A. - 14,784 acres.

Q. 7. How many square miles is this?

A. - 23 square miles.

Q. 8. How many barberry bushes would it take to produce one spore for every square inch of land surface in your county?



Q. 9. What is the damage in dollars that has been traced to rust spread from a single common barberry?

A. - The damage traceable to a single bush is very hard to determine because of the long distance which spores may be blown. However, damage to the extent of \$50,000 was definitely traced to a single common barberry in Indiana.

Combined with the following facts, some amazing results may be obtained. A single red rust spot on a grain plant may contain one hundred thousand spores, each capable of causing more rust on the same or other grain plants. From the time infection occurs until a new crop of spores is formed, about ten days have elapsed. Each of the new spores may repeat the process. In ordinary seasons at least four to six crops of red spores may be produced between the time the barberry begins spreading rust and the time of harvest. Fortunately, many of the spores produced fail to survive.

### Geography

Study the area in which the barberry eradication campaign is being carried on. Where is most of our spring wheat grown? Winter wheat? Give reasons for clearing this area of all common barberry bushes.

### Spelling

barberry	destructive	cooperation	chemical	germinating
eradication	disease	campaign	kerosene	common
destroys	epidemic	yield	average	European
stem rust	damage	weather	production	grain
spore	agriculture	reduced	escaped	sprouts
Japanese	cluster-cup	spine	prevention	resistant
infection	wheat	furrowed	distribution	bristle-toothed





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A LESSON PLAN BY WHICH MONTANA TEACHERS MAY  
PRESENT THE SUBJECT "BLACK STEM RUST AND THE COMMON BARBERRY."

Furnished to the schools of Montana by the Office of Cereal Crops and Diseases, Bureau of Plant Industry, United States Department of Agriculture, in cooperation with the State Agricultural College, Bozeman, Montana, and the Conference for the Prevention of Grain Rust, 300 Lewis Building, Minneapolis, Minnesota.



The following lesson plan has as its basis a general lesson plan prepared by Noel E. Thompson<sup>1</sup> and Donald G. Fletcher<sup>2</sup>. It has been revised and adapted to the needs of Montana schools by Wm. L. Popham<sup>3</sup>, State Leader of Barberry Eradication in Montana.

1. Associate Pathologist, Office of Cereal Crops and Diseases, Bureau of Plant Industry, U. S. Department of Agriculture.
2. Secretary of the Conference for the Prevention of Grain Rust, 300 Lewis Building, Minneapolis, Minnesota.
3. Agent, Office of Cereal Crops and Diseases, U. S. Department of Agriculture.



## LESSON PLAN

A plan by which the teachers of Montana may be guided in presenting the essential facts concerning stem rust and its prevention through the eradication of the common barberry.

### Teacher's Aim:

(1) To become familiar with the common barberry and its relation to black stem rust, and (2) to impart this information to the students.

### Student's Aim:

(1) To learn the essential facts concerning the life history and the importance of black stem rust; (2) To learn to recognize the common barberry and distinguish it from shrubs, including the Japanese barberry; (3) To learn to recognize the four stages of stem rust; and (4) To disseminate this information in the community.

### Possible Correlations

The study of the common barberry may be advantageously included in the study of any or all of the following subjects: Botany, Biology, General Science, Agriculture, and Nature Study.

### Definitions

Before beginning the study of black stem rust the following definitions should be mastered:

**PARASITE:** A living organism, either an animal or a plant, that lives on or in some other organism from which it derives its nourishment for the whole or a part of its existence. It produces no food of its own. A plant parasite, then, is a plant which steals its food from another living plant. Most such parasites are fungi, but not every fungus is a parasite as some are called saprophytes because they live on dead material.

**FUNGUS:** A fungus is a plant devoid of green coloring matter. Unlike green plants, it does not produce its own food materials, but obtains them from living or dead organic matter. It reproduces usually by means of spores. Examples of fungi: Toadstools, puffballs, bread molds, rusts, smuts, etc.

**SPORE:** A spore is a minute reproductive body or cell. It might very well be called the seed of a fungus.

**HOST or HOST PLANT:** Host plant is a term applied to the plant on or in which a parasite lives and from which it gets its food.





**LIFE CYCLE:** The life cycle of a plant or animal is the series of stages through which it passes before completing its full development.

**Examples:** An example of this can be found in the four stages of the life cycle of the butterfly. First, the egg, then the worm, next the pupa, and finally the butterfly. Black stem rust furnishes one of the best examples of the life cycle of a parasitic fungus.

### Sources of Information

United States Department of Agriculture Farmers' Bulletin 1058 and Department Circulars 269 and 356, Montana Experiment Station Bulletin No. 196. Pamphlets prepared by the Conference for the Prevention of Grain Rust, 300 Lewis Building, Minneapolis, Minnesota, an agency cooperating with the United States Department of Agriculture and the States.

### Suggestions to the Teacher

The loss of grain in the principal grain-growing areas of the United States from black stem rust has increased greatly in the past fifty years somewhat in proportion to the number of common barberry bushes. These bushes were introduced and planted as shrubbery and hedges, but their seeds have been scattered by birds and cattle to waste lands and wooded areas. Almost every farmer who has raised grain has suffered losses from black stem rust. Effective control of this disease is of vital interest to American agriculture. It is of especial importance in Montana where so much spring wheat is grown.

Small grains are attacked also by several other plant diseases which in some sections cause severe damage. The diseases most easily confused with stem rust are the leaf rusts of cereals, including crown rust of oats. Where the leaf rusts occur, pupils should be taught to distinguish between the leaf rusts and black stem rust, which is the only grain rust spread by the common barberry.

Read the bulletins carefully. Familiarize yourself with the answers to the questions. Allow the pupils to study the material, the bulletins, and the charts, before beginning any discussion on the subject. Divide the study questions into several recitation periods as thought best. Emphasize the identification of the common barberry bush. Have the pupils bring to school samples of any bushes they may believe to be the common barberry and, if necessary, send the samples to the Botany Department, State Agricultural College, Bozeman, Montana, for identification. Encourage the pupils to ask their parents about black stem rust and the damage it does. Explain carefully the relation of the common barberry to this rust. Point out clearly that the destruction of every common barberry is absolutely necessary for the successful control of black stem rust. Encourage the pupils to look for barberry bushes. When one is found, let all the neighbors see it and then report its location to the Barberry Eradication Office, State Agricultural College, Bozeman, Montana.



A. Relation of Common Barberry to Black Stem Rust

Question 1. What is black stem rust?

Answer - Black stem rust is a fungous parasite which attacks wheat, barley, oats, rye, and many of the tame and wild grasses.

Reference - Montana Experiment Station Bulletin 196, p. 4, U. S. Department of Agriculture Farmers' Bulletin No. 1058, pp. 5 & 6; Department Circular 269, p. 12; Department Circular 356, p. 1.

Q. 2. Explain why and how the kernels are shriveled when rust attacks the plant severely.

A. - The rust attacks the grain plant and robs it of the food which is intended for the development of the kernels. As a result these kernels are undernourished, and shriveled from lack of food.

Q. 3. Name the four stages in the life cycle of stem rust.

A. - The four stages of black stem rust are:

- (1) The yellow cluster-cup or spring-spore stage. Develops only on the barberry bush. Produces yellow spores.
- (2) The red or summer-spore stage. Develops only on grains and grasses. Its reddish-brown spores spread to other grains and grasses and produce a second crop. In like manner, successive crops of summer spores develop about every ten days throughout the summer.
- (3) The black or winter-spore stage. Develops only on grains and grasses. Follows the summer stage, producing its black spores in the red-spore pustules or in new pustules.
- (4) The colorless-spore stage. Produced in the early spring by germinating black spores. These colorless spores infect only the barberry, producing the cluster-cup stage.

Ref. - Montana Bulletin 196, p. 6; Farmers' Bulletin 1058, pp. 5 & 6; Department Circular 269, p. 12; Department Circular 356, p. 2.

Q. 4. Why will the eradication of the common barberry in Montana and adjacent States tend to stop destructive stem-rust epidemics?

A. - Without the common barberry, the black-spore stage which lives over the winter can not infect grains and grasses. The red stage, which can infect grain directly, does not live over winter in these States.

Ref. - Montana Bulletin 196, p. 5.

Q. 5. What effect does favorable, that is, hot, wet weather have on black stem rust?

A. - Hot, wet weather speeds up the production of rust spores, which enables the rust to spread rapidly.

Ref. - Montana Bulletin 196, p. 4.





Q. 6. What color is the rust produced on a grain plant after it becomes infected by the spores from a rusted barberry bush?

A. - The first stage of the rust which appears on grain plants is brick red.

Ref. - Montana Bulletin 196, p. 4.

Q. 7. How is rust spread from the barberry to grains and grasses?

A. - The rust is spread from the barberry to grains and grasses by tiny spores carried by the wind. These spores are so small that they can not be seen with the naked eye.

Q. 8. Can this red rust on the grain plants infect other grain plants? Does stem rust produce one crop or more than one crop of red spores during the summer? How often may a new crop of red spores be produced if weather conditions are favorable?

A. - Yes, the red rust on the grain plants can infect other grain plants by means of the red spores. Stem rust may produce a number of crops of red spores during the summer, the number depending on weather conditions. Under favorable weather conditions a new crop of red spores may be produced every seven to ten days. Each new spore may infect another plant and thus aid in the spread of rust.

Ref. - Montana Bulletin 196, pp. 4 & 5; Department Circular 356, p. 2.

Q. 9. Can black spores directly infect grains and grasses?

A. - No, black spores can not directly infect grains; they are the resting spores of which the rust survives the winter.

Ref. - Montana Bulletin 196, p. 5; Farmers' Bulletin 1058, p. 6; Department Circular 356, p. 2.

Q. 10. Can the black spores directly infect the barberry?

A. - No, the black spores germinate and produce the colorless spores which infect the common barberry.

Ref. - Montana Bulletin 196, p. 5; Department Circular 356, p. 2.

Q. 11. What are the only plants that can be infected by the colorless spores of black stem rust?

A. - Only some plants belonging to the barberry family.

Ref. - Montana Bulletin 196, pp. 10 to 12; Farmers' Bulletin 1058, pp. 5 & 6.

Q. 12. Do all kinds of barberries spread black stem rust?

A. - No. The Japanese barberry does not spread stem rust.

Ref. - Montana Bulletin 196, p. 11; Department Circular 356, p. 3.



Q. 13. What is one of the best methods of controlling black stem rust?

A. - The eradication of the common barberry is one of the best methods of controlling stem rust in both the northern United States and many foreign countries, because the red spores do not live through the winter in the northern States, and because the black spores and the colorless spores are harmless without the barberry.

Ref. - Montana Bulletin 196, p. 5; Farmers' Bulletin 1058, pp. 5, 6, & 7; Department Circular 269.

Q. 14. Would the eradication of all the common barberries on one farm protect the grain on that farm from black stem rust?

A. - No; because spores of stem rust may be blown from barberries or rusted grain on other farms. Rust spores, being very small, may be carried by the slightest breeze.

Ref. - Montana Bulletin 196, p. 6.

Q. 15. Could the barberries in the neighboring States produce rust which might spread to the grain in this State?

A. - Yes, under favorable weather conditions it is very likely that spores from barberry bushes in one State could be blown into another State and cause rust infections.

Ref. - Montana Bulletin 196, p. 6.

Q. 16. What have other countries done to control black stem rust?

A. - Several foreign countries, notably Denmark, have passed laws compelling the destruction of the common barberry. In each of these countries serious damage from black stem rust no longer occurs.

Ref. - Montana Bulletin 196, p. 8.

#### B. Losses Caused by Black Stem Rust

Q. 1. Why is the market value of shriveled grain greatly reduced? (Compare a sample of rust-shriveled grain with a sample of plump grain which has not been damaged by rust.)

A. - Shriveled grain is not as heavy as the plump grain, and its value is also reduced by the fact that it is not well suited for milling purposes.

Go to your local elevator and inquire the market price of wheat weighing 58 pounds to the bushel and wheat weighing 48 pounds to the bushel. (Wheat that has been attacked by rust very often weighs ten or more pounds less than wheat which has been free from rust and other disease.)

Q. 2. What is the average annual stem-rust loss in the United States? In Montana?

A. - The average stem-rust loss to small grains in the United States is estimated at nearly 50,000,000 bushels annually for the 12-year period 1915 to 1926, inclusive. In Montana alone in the same period the average annual loss is estimated at about 1,503,900 bushels.

Ref. - Montana Bulletin 196, p. 4 and p. 19.





Q. 3. Has barberry eradication reduced stem-rust losses in Montana?

A. - Yes. Although the campaign to remove all of the barberries is far from completed, stem-rust epidemics have become less severe and the general annual occurrence of stem rust has been considerably later.

#### C. Identification of Common Barberry

Q. 1. Describe the appearance of the common barberry bush as to shape and size.

A. - The common barberry is an erect shrub of graceful habit. It ranges from a seedling bush of a few inches to a mature shrub of possibly twelve or more feet. The color of the leaves is a dull green. There also is a variety of the common barberry which has purple leaves.

Ref. - Montana Bulletin 196, pp. 10 and 11; Department Circular 356, p. 2.

Q. 2. Describe the outer bark, inner bark, leaves, thorns, flowers, and berries of the common barberry.

A. - The outer bark is grayish in color and is furrowed, the inner bark a bright yellow. The leaves normally are produced in clusters. They always have bristle-toothed edges. The three-pointed thorns occur at the base of the leaf clusters. The flowers are yellow. The berries are green in the summer and red in the fall and winter. They are produced in drooping bunches like currants.

Ref. - Montana Bulletin 196, pp. 10 and 11; Department Circular 356, p. 2.

Q. 3. Compare the bark, branches, leaves, flower clusters, and berries of the common barberry with those of the Japanese or harmless barberry.

A. - The bark of the common barberry is gray and furrowed, in comparison with the reddish-brown, smooth bark of the Japanese barberry. The branches of the common barberry grow erect, but those of the Japanese barberry are spreading, rarely attaining a height of over four feet. The leaves of the common barberry have bristle-toothed edges; those of the Japanese barberry have smooth edges. The thorns of the Japanese barberry usually occur singly at the base of the leaves. The flower clusters and the berries of the common barberry grow in bunches like currants while on the Japanese barberry the flowers and berries appear singly or in pairs.

Ref. - Montana Bulletin 196, pp. 10 and 11; Department Circular 356, p. 3.

#### D. Other Methods of Black Stem Rust Control

Q. 1. What effect does the early planting of spring grain have on the control of stem rust?

A. - The early planting of spring grain may help it to mature earlier and thus escape the late epidemics of stem rust.



Q. 2. How can the farmer help the grain to get a good start so that it can ripen before the rust damages it?

A. - Proper crop rotation, proper fertilizers, thorough preparation of the seed bed, early seeding, and the use of early and best adapted varieties of grain will aid in the production of a sturdy plant which is less likely to be attacked by rust than weaker plants.

Q. 3. Are there varieties of spring wheat that are more resistant to stem rust than others? What are they?

A. - Most of the varieties of red hard spring common wheat are more susceptible to black stem rust than are the durum wheats. Of the durums, Monark and Nodak are more resistant than Kubarka and Arnautka, the standard varieties. Of the common varieties, Kota and Ceres are more resistant to stem rust than Marquis, the most widely grown variety of spring wheat.

#### E. The Introduction and Distribution of the Common Barberry in the United States.

Q. 1. Is the common barberry native to the United States?

A. - No.

Q. 2. Where did the common barberry come from, and how has it been distributed throughout the country?

A. - The common barberry is thought to be native to the mountains of middle and western Asia, where it was used by man as a medicinal plant. As civilization advanced, the bush was carried either by root or seed wherever the new settlers went. In addition to the use of its leaves and bark for medicinal purposes, the berries have been used in making jellies and wines, and the yellow roots were made into dyes. Later the shrub was used as a hedge fence and for ornamental purposes. For this latter use it was commercialized by nursery companies and sold throughout the United States.

Q. 3. Are there any harmful barberries native to North America?

A. - Yes, two species of harmful barberry have been found to be native to North America. Neither of these species is native to Montana. One of the native species, called Berberis canadensis, has been found in Illinois, Indiana, and Kentucky and in the Allegheny Mountains. The second species, Berberis Fendleri, has been found in Colorado. Mahonia aquifolium and Mahonia repens, both commonly called Oregon grape, are closely related to the common barberry and are native to Montana. Mahonia aquifolium has been found only on the western slope of the Rocky Mountains, but Mahonia repens is generally distributed throughout the mountainous region of this State. Neither of these, however, has ever been found infected with black stem rust in its natural habitat. Mahonia aquifolium has been infected artificially.

Ref. - Montana Bulletin 196, p. 12; Department Circular 353, p. 3.





Q. 4. By what means are the seeds of the common barberry scattered from a seed-bearing bush?

A. - The barberry seeds are scattered principally by birds, but also by cattle and other animals, by man, and by running water.

Ref. - Montana Bulletin 196, p. 14.

Q. 5. How long do barberry seeds lie in or on the ground before germinating? How does this increase the difficulty of barberry eradication?

A. - Barberry seeds have been known to lie in or on the ground for as long as six years before germinating. For this reason several reinspections of properties on which bushes have been destroyed are necessary.

#### F. The Eradication of the Common Barberry

Q. 1. Does Montana have a quarantine and a law condemning the common barberry?

A. - Yes. The quarantine was issued by the Governor on April 28, 1918. The law was passed in 1919. Similar laws are in force in each of the other States in the barberry eradication area.

Ref. - Montana Bulletin 196, pp. 22 to 24.

Q. 2. How are common barberry bushes killed?

A. - Common barberry bushes may be killed by digging or by the application of salt or kerosene to the base of the bushes.

Ref. - Montana Bulletin 196, pp. 20 and 21; Department Circular 356, p. 3.

Q. 3. Why is digging often unsatisfactory?

A. - Digging is unsatisfactory because a small root fragment left in the ground may produce sprouts which will spread stem rust.

Ref. - Montana Bulletin 196, p. 20; Department Circular 356, p. 3.

Q. 4. Why is it necessary to revisit properties even after the original barberry bushes have been removed?

A. - Because the seeds may lie in or on the ground for a period of several years before germinating, and also because bushes that have been dug very often produce sprouts.

Q. 5. Why must care be exercised in placing salt or kerosene on barberry bushes growing in a lawn?

A. - Salt or kerosene placed upon barberry bushes growing in a lawn or hedge also may kill valuable shrubbery or other vegetation within an area of five or six feet. For this reason care must be used in the application of these two chemicals.

Ref. - Montana Bulletin 196, p. 21; Department Circular 356, p. 4.



Q. 6. If you find a bush which you think is common barberry, to whom would you send a sample for definite identification?

A. - Samples of bushes suspected to be common barberry will be identified free of charge if they are mailed to the Botany Department, State Agricultural College, Bozeman, Montana.

Q. 7. If you find a bush which you think is common barberry, should you destroy it?

A. - No one should destroy any shrubbery until a sample of it has been properly identified. In this way valuable hedges and shrubbery will not be destroyed by mistake.

### Practical Exercises

Ask the pupils to bring in some of the black stage of the rust, which is present on the stubble of most grain fields. Examine the rusted straw under a hand lens or a microscope. Notice how the rust has broken through the straw. Scrape some of the black spores from the stem into a drop of water on a glass slide. Place a cover glass on the material and examine under the microscope. Note that the black spores are two-celled. Note their comparatively thick walls. Each cell of a black spore may germinate in the spring and produce the tiny colorless spores which infect the common barberry.

If the red or summer stage of the rust is available, prepare a microscope slide of it. Compare the size, shape, and color of these spores with the black spores. Note, that the red spores are only one-celled and are oval in shape. Note, too, that the walls on the red spores are thin. It is for this reason that these spores soon dry out or are killed quickly by cold weather.

Have the pupils draw a twig of the common barberry showing the chief characteristics by which the bush may be identified.

### Interesting Facts About the Common Barberry and Black Stem Rust and the Barberry Eradication Campaign

1. A mid-sized barberry ( 6 to 7 feet tall) has approximately 25,000 leaves.
2. As high as 80% or 28,000 of these leaves may be infected in a year favorable for stem rust.
3. There is an average of 8 rust clusters on an infected barberry leaf. This means that an infected mid-sized barberry may have 224,000 pustules of cluster cups.



4. Each pustule of cluster cups contains an average of 36 cluster cups, and each cluster cup contains about 11,500 spores. This means that the bush would have 8,064,000 cluster cups which would contain 92,736,000,000 spores.
5. If the wind distributed these spores so that one fell on each square inch of land surface, the spores from this bush would cover 14,784 acres or 23 square miles of land.
6. Fortunately, many of the spores produced fail to survive. Under favorable conditions, however, each of these spores from the common barberry is capable of producing a pustule on a grain plant. A single red rust pustule usually contains more than 100,000 spores. If each of the 92,736,000,000 spores from a rusted barberry infected a grain stem and produced a rust pustule, a total of more than 92,736,000,000,000,000 (92 quadrillion, 736 trillion) spores would be produced.
7. Each of these new spores is capable of producing a new pustule of 100,000 spores on the same or other grain plants. In ordinary seasons at least four to six crops of red spores may be produced between the time the barberry begins spreading rust and the time of harvest. A single common barberry therefore may be responsible for billions and billions of rust spores during a single season.

#### The Barberry Eradication Campaign

1. A well-organized campaign is now under way in Montana and twelve other States to destroy all common barberry bushes.
2. A farm-to-farm survey and a city survey have been made in two-thirds of the counties of Montana. All of the barberry bushes found have been destroyed.
3. Since the beginning of the campaign in 1918, over 11,400 common barberry bushes have been destroyed in Montana. Over 14,300,000 have been destroyed in the 13 States of the Barberry eradication area.
4. Most of the bushes found in Montana have been planted bushes.
5. Barberry bushes were found to have escaped from cultivation in Yellowstone, Fergus, Carbon, Flathead, Gallatin, and Lake Counties.
6. The campaign must be completed with the least possible delay to prevent further spread of the common barberry by seeds.
7. The success of this campaign depends to a large extent on the cooperation of the citizens of the State.

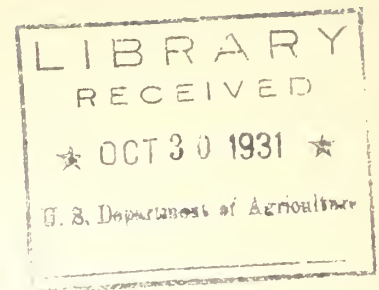




### Community Survey

1. Have each pupil make a detailed report of the methods of growing wheat in the community, giving the names of the varieties planted, methods of preparing the seed bed, the rotation of crops, the fertilization of the land, time of seeding, and methods of harvesting the crops.
2. Find out whether more or less wheat is grown in the community than in 1913. In 1920. If less wheat is being grown, explain why.
3. Find out from the local farmers, elevator men, or threshermen to what extent wheat, oats, barley, and rye are damaged by stem rust.
4. What are local farmers doing to reduce losses from stem rust?
5. Have each pupil survey his own home property for barberries. Combine a survey for barberries with other field trips.





THE ERADICATION OF THE COMMON BARBERRY

A lesson plan for teachers in Montana.

Issued by the Division of Barberry Eradication  
Bureau of Plant Industry  
U. S. Department of Agriculture  
1931

"The destruction of all common barberry bushes is a  
huge task. Good citizenship means cooperation."

# THE ERADICATION OF THE COMMON BARBERRY

## How to Use These Plans

- Design: To meet the needs of the recitation type of class, but could be adapted to the group or contract type, being given as problems.
- Arrangement: Arrangement of lesson topics is in accordance with the logical sequence of procedure and anticipates questions as they would arise in the mind of the student.
- Study Date: Lessons should be taken up in the spring at the time when bushes have leaves and conditions are right for field trips. Spring and summer may then be used by students in the follow-up work.
- Texts: A convenient booklet is published by the United States Department of Agriculture as Miscellaneous Publication No. 7, January, 1928, entitled "Bread or Barberries." Page references are given in the plans to this publication and also to U. S. Dept. Agr. Circ. 356, entitled "The Common Barberry and How to Kill It." It is suggested that enough of these be secured for the entire class.
- Materials: Pamphlets and posters may be obtained from your State Agricultural College. Help the Government distribute posters by tacking them up in conspicuous places in the community when the class is through with them.
- Assignments: Assignments should be made the day previous to the recitation. Assignments for advance work are important. Special care should be used to make everything clear, as this will increase the efficiency of the students' study time and increase the value of the recitation period. The points listed under "A. To stimulate interest" will stimulate in the child a desire to study the assignment.
- Aims: Both teacher and pupil should have in mind a definite aim while studying each lesson. The pupil's aim should be suggested while making assignment.
- Double-Column Guide: This guide to recitation gives the teacher definite information opposite each question - at all times ready reference for those teachers not familiar with the technical phases of the subject.
- Time: If the suggested time for each division of the lesson plan is carried out, it is believed better results will be obtained.

### Assignment for Lesson 1.

#### Black Stem Rust and the Resulting Economic Losses.

- A. To stimulate interest:
  - What things do you eat containing products made from wheat or other small grains?
  - What does black stem rust do to the grains?
  - Why is grain important?
- B. Reading matter:
  - Read pages 8, 9, 10, and 11 of U. S. Dept. Agr. Misc. Pub. 7. "Bread or Barberries."



C. Pupil's Aim:

To learn to what extent black stem rust is affecting small grains.

LESSON 1

Assignment for Lesson 2: (2 minutes)

Black Stem Rust and How It Lives

A. To stimulate interest:

What is black stem rust?

Where does it live?

What plants does it live upon?

B. Reading matter:

Answers will be found on pages 1 - 6 of U. S. Dept. Agr. Misc. Pub. 7, "Bread or Barberries."

C. Pupil's Aim:

Let us try to find out how and where this enemy is living.

Today's Lesson:

Black Stem Rust and the Economic Losses it is Producing

A. Aims:

1. Teacher: To bring to the student the fact that black stem rust is causing tremendous losses to our grain crops, and that if allowed to continue and increase it will constitute a serious menace to our national supply of food.

2. Pupil: To learn to what extent black stem rust is affecting the small grains.

Materials Needed:

A. Samples - Black stem rust on stems from local fields. Shriveled kernels of wheat, barley, rye, and oats. Perfect kernels of wheat, barley, rye, and oats. Cereal products - Rolled oats, flour, rye bread, etc.

B. Posters - "What Black Stem Rust Does to Our Small Grains."

Introduction: (1 minute)

Black stem rust is a disease that affects grain, wheat, oats, rye, and barley and cripples them much as infantile paralysis cripples children." The United States Government and the State

Department of Agriculture, in cooperation with the Conference for the Prevention of Grain Rust, have issued a call to us, each of us, to come out and fight this grain disease. In order to be good soldiers we need to find out who, what, and where our enemy is. Today we shall discover to what extent grain rust is troubling our crops in the United States.

## LESSON 1      Teacher's Guide to Recitation (17 minutes)

Answers and References	Main (Pivotal) Questions
1. Show specimens of different grain products.	1. What products do we make from perfect grains? (Allow student to name and then pick from your supply his specimen for exhibit to the class.)
2. Food - Man and Animal Textile) Paper ) Straw Alcohol - Legitimate uses Industry (Page 11 of "Bread or Barberries.")	2. Why are we dependent upon these grains?
3. Display samples, from local grain showing the effect upon the stem.	3. What does black stem rust look like?
4. Display grain kernels of as many different grains as you can obtain. Show perfect kernels and shriveled ones. If not able to obtain, show cut on page 10 of "Bread or Barberries."	4. What does it do to the grain? (a) Would these damaged kernels make good flour? Good cereals.?
5. Colorado, Illinois, Indiana, Iowa, Michigan, Minnesota, Montana, Nebraska, North Dakota, South Dakota, Ohio, Wisconsin, Wyoming.	5. What States are most affected by grain rust? (a) Where are these States located? (b) Why are they most stricken?
6. Place before the student, the poster "What Black Stem Rust Does to Our Small Grains."	6. To what extent are these grain States affected? (a) Review State by State. (b) The average annual loss of wheat due to stem rust from 1916 to 1930, inclusive, is 28,000,000 bushels.

Answers and References	Maine (Pivotal) Questions
<p>7. U. S. Dept. Agr. Circ. No. 356. page 1.</p> <p>8. Same poster as question 6.</p> <p>9. Feed all hungry people in the United States and foreign lands.</p> <p>10. Become a national menace.</p>	<p>7. The quantity of wheat lost in 1916 alone would make 11,000,000,000 loaves of bread.</p> <p>8. What has this loss meant in dollars and cents? Average annual loss from 1916 to 1930, more than \$40,000,000.</p> <p>9. What could we do with this waste?</p> <p>10. What will happen if we do not check the spread of black stem rust?</p> <p>11. Having uses these posters, we shall display them in the community where people may see them.</p>

## LESSON 2

Assignment for Lesson 3: (2 minutes)

History of Common Barberry

- A. To stimulate interest:  
How long has man known this plant?  
Why has it been cultivated although a pest?  
Of what use has it been?
- B. Reading matter:  
Find answers on pages 6, 7, 8, and 12 of "Bread or Barberries."
- C. Pupil's Aim:  
To look backward a few years and see if barberry toleration is worth what it costs.

## Today's Lesson:

### Black Stem Rust and How it Lives

#### A. Aims:

1. Teacher: To give a biological insight into the habit and life cycle of rust and to show that eradication of the common barberry will relieve the serious existing condition.
2. Pupil: To learn the habits and haunts of rust in order to combat this enemy in an intelligent way.

#### Materials Needed:

- A. Samples - Black stem rust on stems - local fields.  
Plate 3 - from "Conference for the Prevention of Grain Rust, Minneapolis."  
Plate 1 - The Life Cycle of the Black Stem Rust.  
Envelope containing common barberry and "cluster-cups."

#### Introduction: (1 minute)

Having found yesterday that black stem rust is damaging our crops a great deal, today we wish to learn how we may best combat this enemy. Let's take an example: Suppose that in our town, people were suffering from mosquitoes a great deal. Mosquitoes hatch only in stagnant water. On the outskirts of town we find a few stagnant pools. Which is easier, to rid ourselves of the pools or of the mosquitoes? Perhaps by knowing the complete life habits of the rust, finding where it lives, we may deal with it likewise.

### LESSON 2      Teacher's Guide to Recitation (17 minutes)

Answers and References	Main (Pivotal) Questions
REVIEW - A short answer period not over 2 minutes in length, covering main points of yesterday's lesson.	Is plump grain important, and why? What is the worst grain enemy? What States are most affected?
ADVANCE: 1. Have at hand the samples of rust on stems, used in yesterday's work. (a) It is a plant - fungus. (b) It does not manufacture its own food but steals it from living plants.	ADVANCE: 1. Why is this disease called a rust? (a) Is this disease a plant or an animal? (b) Why is this plant called a parasite?

Answers and References	Maine (Pivotal) Questions
(c) People who are "spongers" on society.	(c) Do we have any human parasites?
2. One year.	2. How much time does it take to make a complete trip around the life cycle of the rust?
3. (a) Spring - Barberry only. (b) Summer - Grain and grass. (c) Fall - Grain and grass. (d) Winter - Grain and grass.	3. Name the four stages of its life. (a) What parts of the year do they occupy? (b) Where <u>only</u> does the rust live in the spring?
4. Supply class with a plate which shows stages. Plate 3.	4. Trace these stages on plates. Point out microscopic parts, and spores. Show that stage 5 is the same as stage 1.
5. Plate 1	5. Show life cycle on Plate 1.
6. Supply class with an envelope containing a sample of common barberry with "cluster-cups."	6. How does rust appear on the common barberry? (Show envelopes.)
7. Wind carries thousands of spores from cluster-cups.	7. How does this stage get to the grain?
8. The cluster-cup spores from the barberry may spread rust by direct infection to a distance of many miles. As soon as the red or summer stage of rust appears on grains or grasses the wind can again carry the red spores for miles and scatter them on grain fields. The production of red-rust spores on the grain is repeated every 6 to 10 days in favorable weather. Rust has been traced for more than 100 miles after starting from a single group of barberry bushes.	8. How large an area may be affected by the rust from one group of barberries?



Answers and References	Main (Pivotal) Questions
<p>9. Produces pustules on stems. This chokes the plant and prevents food from reaching kernels that are developing, by allowing the sap of the plant to evaporate through the rust pustule openings. Shriveled kernels result.</p> <p>10. The locations of common barberry bushes should be reported to the Barberry Leader, District Office of Barberry Eradication, Box 1777, Fargo, N. Dakota, so that the bushes may be destroyed before further damage occurs. (a) The common barberry.</p>	<p>9. How does the rust spoil the grain?</p> <p>10. Now what can we do? (a) Which home of the rust should be destroyed, the grain or common barberry?</p>

## LESSON 3

Assignment for Lesson 4: (3 minutes)

Identification of the Common Barberry

- A. To stimulate interest:
- Have you ever seen the common barberry?
  - It is a large or a small plant?
  - How can you tell one when you see it?
  - In what way may it be distinguished from other shrubs?
- B. Reading matter:
1. Description on page 2, U. S. Dept. Agr. Circ. 356.
  2. Study samples in envelopes and make drawings of the leaves and spines.
  3. Study Plate 2 (distinguish between Japanese and common barberry).
- C. Pupil's Aim:
- To learn to know the common barberry wherever seen.

Today's Lesson:

History of the Common Barberry

A. Aims:

1. Teacher: To give to the student the facts regarding the common barberry which will help to dispel the traditional belief that the common barberry is an ornamental friend.
2. Pupil: To look backward a few years and determine whether barberry toleration is worth what it costs.

Materials Needed:

- A. "Bread or Barberries." U. S. Dept. Agr. Misc. Pub. 7.

Introduction: (1 minute)

From your reading you have gathered that the common barberry is not new to man. It has a checkered history. Is it worth to us all that it costs to tolerate it? By looking back over its records of the years, we should be able to sit as a jury and determine the fate of the common barberry.

LESSON 3      Teacher's Guide to Recitation (16 minutes)

Answers and References	Main (Pivotal) Questions
<b>REVIEW</b> - A short answer period not over 2 minutes in length covering main points of yesterday's lesson (2)	Name four stages of rust life. How much time do they occupy? Where does the rust live in the spring? What does rust do to the grain?
<b>ADVANCE:</b> 1. 2,500 years, or more.	<b>ADVANCE:</b> 1. How long have men been acquainted with the common barberry?
2. Asia, India, Hindu writers.	2. In what country do we first hear of it? Who reported it?
3. Medicine from leaves and bark. Dyes and inks; yellow, green, red. Wood is tough, used for rake teeth. Leaves tender in spring, used as lemon juice is used; was acid; to make vinegar; make jam or jelly. Hedges - thorny.	3. Why was it important? How did men use it?

Answers and References	Main (Pivotal) Questions
4. Seeds carried by man, birds, water, wind; Young plants transplanted by men.	4. How was common barberry spread throughout Europe?
5. Carried here as a friend by colonists.	5. How did it come to United States, where it was not native?
6. Lowell: "All down the loose walled lane in archin' bowers "The barberry droops its strings o' golden flowers."	6. What poet has mentioned the barberry?
7. Carried by pioneers. Used for hedges and shrubbery around houses.	7. How has common barberry spread to the Western States. For what used?
8. Noticed that if wind blew over hedge the grain on the windward side would rust.	8. How did men discover barberry -- the traitor?
9. Destroyed barberry bushes, and no destructive rust appeared the following year.	9. What did they do, and what were the results?
10. It was not conclusive proof until scientists discovered the stages and habits as we learned them yesterday. (DeBary - 1865.)	10. Was this proof that common barberry bushes spread rust?
11. Barberry eradication organized in U. S. in 1918 - U. S. Dept. of Agr., in cooperation with the 13 Western States affected. Surveys have been made. Schools have been asked to help. Every common barberry must be found and destroyed.	11. What has been done?
12. Denmark eradicated the common barberry and now has no rust.	12. Has any country been successful in barberry eradication?

## LESSON 4

Assignment for Lesson 5: (2 minutes)

### Eradication of the Common Barberry

- A. To stimulate interest:  
There must be a vigorous campaign against any enemy if we expect victory.  
Who is at the head of this campaign?  
Who are the soldiers in this battle?
- B. Reading matter:
  - 1. Pages 13 -- 14 of "Bread or Barberries."
  - 2. Pages 3 -- 4 of U. S. Dept. Agr. Circ. 356.
- C. Pupil's Aim:  
To determine who the leaders are in the struggle against the common barberry and to find what part each individual will be privileged to play.

Today's Lesson:

### Identification of the Common Barberry

- A. Aims:
  - 1. Teacher: To bring before the student the characteristics of the common barberry and to distinguish it from the Japanese barberry.
  - 2. Pupil: To learn to know the common barberry whenever seen.

Materials Needed:

- A. Envelope containing barberry sample showing "cluster cups."

Introduction: (1 minute)

We have shown how dangerous an enemy the common barberry is; that it should be destroyed. We do not wish to kill harmless plants. We therefore must study the plant, preserve any other harmless plants, and prevent the escape of the enemy.

LESSON 4      Teacher's Guide to Recitation (17 minutes)

Answers and references	Main (Pivotal) Questions
REVIEW -- A short answer period not	How long have men known barberry?

Answers and References	Main (Pivotal) Questions
<p>over 2 minutes in length covering main points of yesterday's lesson (3).</p>	<p>Of what importance was it?          What are the harmful effects of barberry?          Is the tolerance of common barberry worth what it costs?</p>
<p>ADVANCE:          If possible it will be best to make this a field trip to some actual bushes and will be outlined as such. If feasible, have the county agriculturist direct this trip. If a field trip is impossible, bring plants of common barberry and Japanese barberry to the room, or use plates provided by the U. S. Department of Agriculture.</p>	<p>ADVANCE:          Designate a student to demonstrate each characteristic that you wish to point out. This should be passed around the class as much as possible, and not to one student only.</p>
<ol style="list-style-type: none"> <li>1. Determined by local conditions.</li> <li>2. 5 to 7 feet tall - sometimes 12 feet, very erect.</li> <li>3. Grayish (outside); yellow (inside).</li> <li>4. Spines usually in groups of three to five, at base of leaf. But may have only one in some cases.</li> <li>5. Have bristle-toothed edges.</li> <li>6. Yellow.</li> <li>7. Clusters of berries - like currants, oblong shaped, bright red.</li> </ol>	<ol style="list-style-type: none"> <li>1. What kind of a place does the common barberry choose in which to live?</li> <li>2. What is its habit of growth?</li> <li>3. Color of bark? Outside? Inside?</li> <li>4. Where are the spines produced-how many?</li> <li>5. What are the peculiarities of the leaves?</li> <li>6. What is the color of the flowers?</li> <li>7. Does the bush have fruit? Describe.</li> </ol>



LESSON 4    Cont'd                      Teacher's Guide to Recitation (17 minutes)

Answers and References	Main (Pivotal) Questions
8. Same leaves, but yellow bark and roots.	8. Describe small sprouts and seedlings. Do you find any?
9. Yes. On underside of leaves.	9. Can you find any cluster cups of the rust?
10. No. Locate bush of Japanese barberry.	10. Should the Japanese barberry bush be destroyed?
11. Japanese rarely over 4 or 5 feet tall. Not erect - spreading. (a) Japanese - reddish. (b) Single usually, although more may occur (c) Smooth edges (d) Single, or two or three. Not in clusters.  (e) No.  (f) No. Save it.	11. What is the difference in habit between the two barberries? (a) Difference in bark? (b) Difference in spines?  (c) Difference in leaves? (d) Difference in berries?  (e) Can you find any rust cluster-cups on the leaves of this plant?  (f) Is it harmful?

LESSON 5

Assignment for Lesson 6: (2 minutes)

Organizing for Action

- A. To stimulate interest:  
Does an army have organization?  
Must we not have organization?  
Should not the public be informed of what we are trying to do?
- B. Each student is to write a 200-word article on the barberry menace and what each citizen's responsibility is. The two best articles will be sent to the local newspaper on successive weeks (or days).

## Today's Lesson:

### Eradication of the Common Barberry

#### A. Aims:

1. Teacher: To link the pupil's interest and knowledge with the constituted campaign against the barberry and to acquaint him with his privilege and duty.
2. Pupil: To determine who are the leaders against the common barberry, and to find out what part each individual will be privileged to play.

#### Introduction: (1 minute)

Victory never is won by passive resistance or cowardice. This nation does not make war on other nations, unless in defense, for we desire peace at all times. But we have been attacked by the common barberry and we must fight. The whole nation's agricultural outlook depends upon the successful eradication of the common barberry. Scientific study has shown that it should be killed, and our perusal of its history has convinced us that we must tolerate it no longer. We must discover our duty in this campaign.

### LESSON 5                      Teacher's Guide to Recitation (17 minutes)

Answers and References	Maine (Pivotal) Questions
REVIEW - A short answer period not over 2 minutes in length covering main points of yesterday's lesson (4).	Distinguish between the two barberries as to habit of growth. Distinguish between color of bark, leaves, spines, fruit. What should be our attitude toward the common barberry?
ADVANCE: 1. U. S. Department of Agriculture. (Point out that no better leader could be secured.)  2. (a) 13 of the North-Central States where wheat is most grown. (b) The State Colleges of Agriculture.	ADVANCE: 1. Who is at the head of the campaign against the common barberry?  2. Who are cooperating with the Government?

Answers and References	Main (Pivotal) Questions
<p>(c) Farmers, newspaper men; nursery men, teachers, and students.</p> <p>(d) State Agricultural Departments.</p> <p>(e) The Conference for the Prevention of Grain Rust, Minneapolis, Minnesota.</p> <p>3. (a) Learn to know the common barberry.</p> <p>(b) Report any bush you find to the County Agriculturist or State College and send a sample twig of the bush and its location to either office. The proper authorities will verify your identification and destroy the bush.</p> <p>(c) Tell the story of the harmful common barberry to anyone who does not understand it.</p> <p>(d) Report any severe outbreak of rust which occurs in your locality to either of the above offices.</p> <p>4. (a) By digging. (Use care to get all roots)</p> <p>(b) Salt treatment. Bush with 12-inch base - 20 lbs. Bush with 6-inch base - 10 lbs. Put salt at base of all shoots. Keep farm animals away from salt, for they may die if they eat too much.</p> <p>(c) Kerosene Bush with 12-inch base - 1 gal. Bush with 6-inch base - 2 qts. Drench ground around all shoots.</p> <p>5. Barberries near valuable shrubs or trees should not be killed with chemicals but should be dug.</p>	<p>3. How can we help.</p> <p>4. How may the common barberry bush be destroyed? (a) Name one method. (b) Name another.</p> <p>(c) Name another method.</p> <p>5. What precautions are necessary in chemical treatment?</p>

## LESSON 6

### Organization for Action

1. Take up papers prepared by class.
2. Introduction: (Not more than 5 minutes) Reserve plenty of time for organizing.

Now comes the test of our loyalty to community, State, and nation. Our study of the common barberry has shown that its eradication will benefit the world. The test of a good citizen is the way he applies himself to the tasks he knows he should do for the sake of his community. You may be good citizens by forming groups for barberry eradication. An army must have organization - so must we. And today if each of you is willing to go at this task whole heartedly, we will organize. You may form two groups, and may compete with each other for the spring and summer. We need a captain for each group; a name; a color; a secretary; poster men; and a display committee. This will give every one something to do.

As an added incentive and reward for the service which we shall render our State and nation, by reporting common barberry bushes, the Conference for the Prevention of Grain Rust will present a beautiful bronze medal to any boy or girl who reports a property on which such bushes are growing. A national organization known as the National Rust Busters Club has been formed of all the boys and girls who promise to "look for common barberry bushes, report them and tell every one how they spread black stem rust." Finding a property having common barberry gives anyone a life membership in the Club, as well as a beautiful medal. See how many medals each group can win.

The number of harmful barberry bushes to be found in your community may be few or many depending upon how many were planted years ago. From 1918 to 1930 a total of more than 18 million bushes and seedlings has been destroyed in our thirteen Northern grain-growing States. Some neighborhoods have very few bushes, others a great many. Carefully inspecting all dooryards, orchards, woodlots, windbreaks, stream banks, and ravines is necessary in order to locate all bushes. Only one bush left growing in a county would be sufficient to cause a serious rust loss as well as to serve as a center from which barberry bushes would spread. Let us become active "Rust Busters."

## Organization

Have class elect two captains.

Captains then choose their groups from the class.

### Group Meetings

Each group selects:

Duties:

Group name.

Group color.

Newspaper correspondent - - - -To give report every two weeks regarding activity of group.

Secretary - - - - -To keep accurate list of all activities.

Poster men - - - - -Direct the making of posters, securing of posters from rust agencies, and posting them.

Display committee - - - - -To prepare full display of barberry, its results, and how and why it should be destroyed. This display should be shown in the town or county fair. It might even be taken to the State Fair.

### Explanation

1. Each group is to hunt common barberry bushes, spring, and summer, whenever it can.
2. Bushes are to be reported to the District Office of Barberry Eradication, Box 1777, Fargo, North Dakota, and then reported to the group secretary, who will keep a record of each person and his activities. All barberry bushes will be treated or dug by Government barberry field agents.
3. Color is for tying on barberry bushes to show others that this bush already has been treated or reported.
4. Each group captain should have a copy of this sheet.

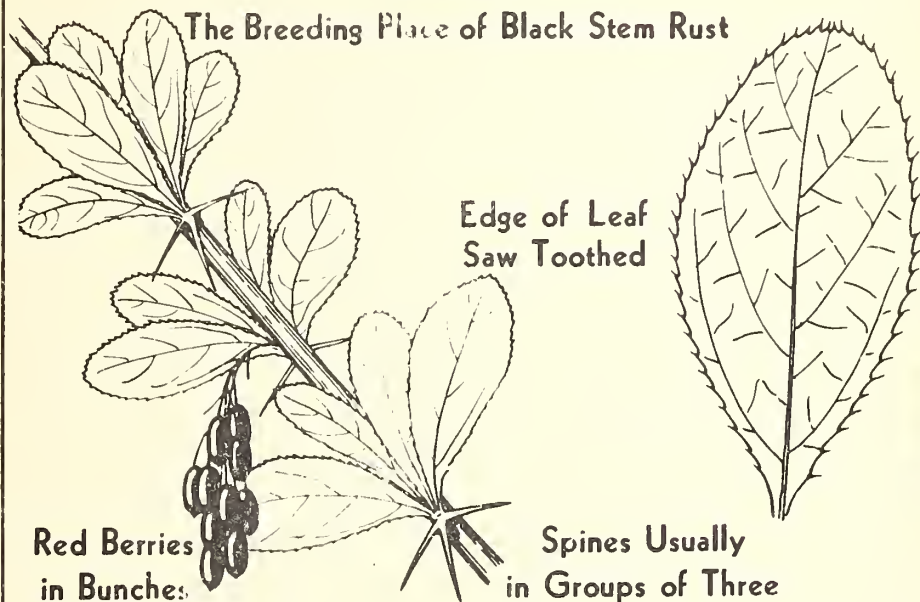




## COMMON BARBERRY

HARMFUL

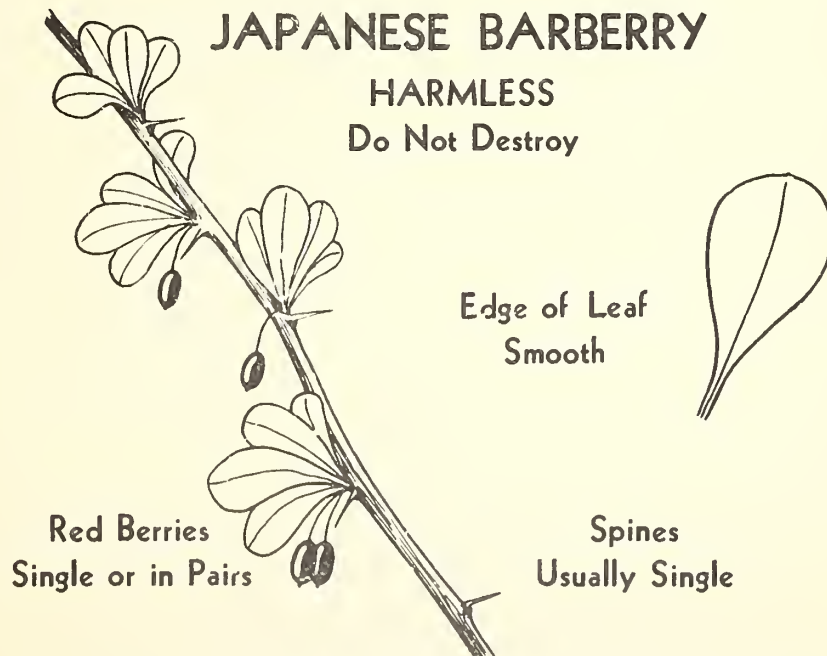
The Breeding Place of Black Stem Rust



## JAPANESE BARBERRY

HARMLESS

Do Not Destroy





1.9  
P69 BLP

A LESSON PLAN BY WHICH NORTH DAKOTA TEACHERS MAY PRESENT THE SUBJECT "BLACK  
STEM RUST AND THE COMMON BARBERRY."

To the teachers of North Dakota:

The enclosed lesson plan for the teaching of the story of  
the common barberry and its relation to the spread of black stem  
rust of grains has my approval and endorsement,

Very sincerely yours,



Bertha R. Falmer, Superintendent,  
Department of Public Instruction.

Furnished to the schools of North Dakota by the Office of Cereal Crops  
and Diseases, Bureau of Plant Industry, United States Department of Agricul-  
ture, in cooperation with the State Agricultural College, Fargo, North  
Dakota, the Conference for the Prevention of Grain Rust, 300 Lewis Building,  
Minneapolis, Minnesota, and the State Department of Public Instruction, Bis-  
marck, North Dakota.

The following lesson plan has as its basis a general lesson plan prepared by Donald G. Fletcher<sup>1</sup> and Noel F. Thompson<sup>2</sup>. It has been revised and adapted to the needs of North Dakota schools by George C. Mayoue<sup>3</sup> and Edward M. Yocum<sup>4</sup> with the aid of the following State Officials and educators:

Miss Bertha R. Palmer, State Superintendent of Public Instruction in North Dakota.

President James A. McFarland of the Minot State Teachers College.

Miss Elsie Cook, critic of the Minot State Teachers College, and President of the North Dakota Parent-Teachers Association.

Mr. Carl E. Publitz, Instructor in Agriculture, and other members of the staff in the training school of the Minot State Teachers College.

1. Secretary of the Conference for the Prevention of Grain Rust, 300 Lewis Building, Minneapolis, Minnesota.

2. Associate Pathologist, Office of Cereal Crops and Diseases, Bureau of Plant Industry, U. S. Department of Agriculture.

3. Associate Pathologist in Charge of Barberry Eradication in North Dakota.

4. Agent, Office of Cereal Crops and Diseases, U. S. Department of Agriculture.



## LESSON PLAN

A plan by which the teachers of North Dakota may be guided in presenting the essential facts concerning stem rust and its prevention through the eradication of the common barberry.

### Teacher's Aim:

(1) To become familiar with the common barberry and its relation to black stem rust, and (2) to impart this information to the students.

### Student's Aim:

(1) To learn the essential facts concerning the life history and the importance of black stem rust; (2) To learn to recognize the common barberry and distinguish it from other shrubs, including the Japanese barberry; (3) To learn to recognize the four stages of stem rust; and (4) To disseminate this information in the community.

### Possible Correlations

The study of the common barberry may be advantageously included in the study of any or all of the following subjects: Botany, Biology, Agriculture, General Science, Nature study, Language, Arithmetic, Geography, and Spelling.

### Definitions

Before beginning the study of black stem rust the following definitions should be mastered:

**PARASITE:** A living organism, either an animal or a plant, that lives on or in some other organism from which it derives its nourishment for the whole or a part of its existence. It produces no food of its own. A plant parasite, then, is a plant which steals its food from another living plant. Most such parasites are fungi, but not every fungus is a parasite as some are called saprophytes because they live on dead material.

**FUNGUS:** A fungus is a plant devoid of green coloring matter. Unlike green plants, it does not produce its own food materials, but obtains them from living or dead organic matter. It reproduces usually by means of spores. Examples of fungi: Toadstools, puffballs, bread molds, smuts, rusts, etc.

**SPORE:** A spore is a minute reproductive body or cell. It might very well be called the seed of a fungus.

**HOST or HOST PLANT:** Host plant is a term applied to the plant on or in which a parasite lives and from which it gets its food.

LIFE CYCLE: The life cycle of a plant or animal is the series of stages thru which it passes before completing its full development.

Examples: An example of this can be found in the four stages of the life cycle of the butterfly. First, the egg, then the worm, next, the pupa, and finally the butterfly. Black stem rust furnishes one of the best examples of the life cycle of a parasitic fungus.

### Sources of Information

United States Department of Agriculture Farmers' Bulletin 1053, and Department Circulars 269 and 356. North Dakota Extension Circular No. 73. Pamphlets prepared by the Conference for the Prevention of Grain Rust, 300 Lewis Building, Minneapolis, Minnesota, an agency cooperating with the United States Department of Agriculture and the States.

### Suggestions to the Teacher

The loss of grain in the principal grain-growing areas of the United States from black stem rust has increased greatly in the past fifty years somewhat in proportion to the number of common barberry bushes. These bushes were introduced and planted as shrubbery and hedges but their seeds have been scattered by birds and cattle to waste lands and wooded areas. Almost every farmer who has raised grain has suffered losses from black stem rust. Effective control of this disease is of vital interest to American agriculture. It is of especial importance in North Dakota where so much spring wheat is grown.

Small grains are attacked also by several other plant diseases which in some sections cause severe damage. The diseases most easily confused with stem rust are the leaf rusts of cereals, including crown rust of oats. Where the leaf rusts occur, pupils should be taught to distinguish between the leaf rusts and black stem rust, which is the only grain rust spread by the common barberry.

Read the bulletins carefully. Familiarize yourself with the answers to the questions. Allow the pupils to study the material, the bulletins, and the charts, before beginning any discussion on the subject. Divide the study questions into several recitation periods as thought best. Emphasize the identification of the common barberry bush. Have the pupils bring to school samples of any bushes they may believe to be the common barberry and, if necessary, send the samples to the Biology Department, State Agricultural College, Fargo, North Dakota, for identification. Encourage the pupils to ask their parents about black stem rust and the damage it does. Explain carefully the relation of the common barberry to this rust. Point out clearly that the destruction of every common barberry is absolutely necessary for the successful control of black stem rust. Encourage the pupils to look for barberry bushes. When one is found, let all the neighbors see it and then report its location to the Barberry Eradication Office, State Agricultural College, Fargo, North Dakota.

#### A. Relation of Common Barberry to Black Stem Rust

Question 1. What is black stem rust?

Answer - Black stem rust is a fungous parasite which attacks wheat, barley, oats, rye and many of the tame and wild grasses.

Reference - N. Dak. Extension Circular No. 73, p. 5; U. S. Department of Agriculture Farmers' Bulletin No. 1053, pp. 5 & 6; Department Circular 269, p. 12; Department Circular 356, p. 1.

Q. 2. Explain why and how the kernels are shriveled when rust attacks the plant severely.

A. - The rust attacks the grain plant and robs it of the food which is intended for the development of the kernels. As a result these kernels are under-nourished, and shriveled from lack of food.

Ref. - N. Dak. Extension Circular 73, p. 6.

Q. 3. Name the four stages in the life cycle of stem rust.

A. - The four stages of black stem rust are:

- (1) The yellow cluster-cup or spring-spore stage. Develops only on the barberry bush. Produces yellow spores.
- (2) The red or summer-spore stage. Develops only on grains and grasses. Its reddish-brown spores spread to other grains and grasses and produce a second crop. In like manner, successive crops of summer spores develop about every ten days throughout the summer.
- (3) The black or winter-spore stage. Develops only on grains and grasses. Follows the summer stage, producing its black spores in the red-spore pustules or in new pustules.
- (4) The colorless-spore stage. Produced in the early spring by germinating black spores. These colorless spores infect only the barberry, producing the cluster-cup stage.

Ref. - N. Dak. Extension Circular 73, p. 5; Farmer's Bulletin 1058, pp. 5 & 6; Department Circular 263, p. 12; Department Circular 356, p. 12.

Q. 4. Why will the eradication of the common barberry in North Dakota and adjacent States tend to stop destructive stem-rust epidemics?

A. - Without the common barberry, the black-spore stage which lives over the winter can not infect grains and grasses. The red stage, which can infect grain directly, does not live over winter in these States.

Ref. - N. Dak. Extension Circular 73, p. 6.

Q. 5. What effect does hot, wet weather have on black stem rust?

A. - Hot, wet weather speeds up the production of rust spores which enables the rust to spread rapidly.

Ref. - N. Dak. Extension Circular 73, p. 7.

Q. 6. What color is the rust produced on a grain plant after it becomes infected by the spores from a rusted barberry bush?

A. - The first stage of the rust which appears on grain plants is brick red.

Ref. - N. Dak. Extension Circular 73, p. 7.

Q. 7. How is rust spread from the barberry to grains and grasses?

A. - The rust is spread from the barberry to grains and grasses by tiny spores carried by the wind. These spores are so small that they can not be seen with the naked eye.

Ref. - N. Dak. Extension Circular 73, p. 7.

Q. 3. Can this red rust on the grain plants infect other grain plants? Does stem rust produce one crop or more than one crop of red spores during the summer? How often may a new crop of red spores be produced if weather conditions are favorable?

A. - Yes, the red rust on the grain plants can infect other grain plants by means of the red spores. Stem rust may produce a number of crops of red spores during the summer, the number depending on weather conditions. Under favorable weather conditions a new crop of red spores may be produced every seven to ten days. Each new spore may infect another plant and thus aid in the spread of rust.

Ref. - N. Dak. Extension Circular 73, pp. 6 & 7.

Q. 9. Can black spores directly infect grains and grasses?

A. - No, black spores can not directly infect grains, they are the resting spores by which the rust survives the winter.

Ref. - N. Dak. Extension Circular 73, pp. 6 & 16; Farmers' Bulletin 1053, p. 6.

Q. 10. Can the black spores directly infect the barberry?

A. - No, the black spores germinate and produce the colorless spores which infect the common barberry.

Ref. - Department Circular 356, p. 2.

Q. 11. What are the only plants that can be infected by the colorless spores of black stem rust?

A. - Only some plants belonging to the Barberry family.

Ref. - N. Dak. Extension Circular 73, p. 6; Farmers' Bulletin 1053, pp. 5 & 6.

Q. 12. Do all kinds of barberries spread black stem rust?

A. - No. The Japanese barberry does not spread stem rust.

Ref. - N. Dak. Extension Circular 73, p. 5.



Q. 13. What is one of the best methods of controlling black stem rust?

A. - The eradication of the common barberry is one of the best methods of controlling stem rust in both the northern United States and many foreign countries because the red spores do not live through the winter in the northern States, and because the black spores and the colorless spores are harmless without the barberry.

Ref. - N. Dak. Extension Circular 73, p. 8; Farmers' Bulletin 1053, pp. 5, 6, & 7; Department Circular 269.

Q. 14. Would the eradication of all the common barberries on one farm protect the grain on that farm from black stem rust?

A. - No; because spores of stem rust may be blown from barberries or rusted grain on other farms. Rust spores, being very small, may be carried by the slightest breeze.

Ref. - General information from all bulletins.

Q. 15. Could the barberries in the neighboring States produce rust which might spread to the grain in this State?

A. - Yes, under favorable weather conditions it is very likely that spores from barberry bushes in one State could be blown into another State and cause rust infections.

Q. 16. What have other countries done to control black stem rust?

A. - Several foreign countries, notably Denmark, have passed laws compelling the destruction of the common barberry. In each of these countries serious damage from black stem rust no longer occurs.

#### B. Losses Caused by Black Stem Rust

Q. 1. Why is the market value of shriveled grain greatly reduced? (Compare a sample of rust-shriveled grain with a sample of plump grain which has not been damaged by rust.)

A. - Shriveled grain is not as heavy as the plump grain and its value is also reduced by the fact that it is not well suited for milling purposes.

Go to your local elevator and inquire the market price of wheat weighing 53 pounds to the bushel and wheat weighing 43 pounds to the bushel. (Wheat that has been attacked by rust very often weighs ten or more pounds less than wheat which has been free from rust and other diseases.)

Q. 2. What is the average annual stem-rust loss in the United States? In North Dakota?

A. - The average stem-rust loss to small grains in the United States is estimated at nearly 50,000,000 bushels annually for the 12-year period 1915 to 1926, inclusive. In North Dakota alone in the same period the average annual loss is estimated at about 19,000,000 bushels.

Ref. - N. Dak. Extension Circular 73, p. 16.



Q. 3. Has barberry eradication reduced stem-rust losses in North Dakota?

A. - Yes. Although the campaign to remove all of the barberries is far from completed, stem-rust epidemics have become less severe and the general annual occurrence of stem rust has been considerably later.

#### C. Identification of Common Barberry

Q. 1. Describe the appearance of the common barberry bush as to shape and size.

A. - The common barberry is an erect shrub of graceful habit. It ranges from a seedling bush of a few inches to a mature shrub of possibly twelve or more feet. The color of the leaves is a dull green. There also is a variety of the common barberry which has purple leaves.

Ref. - N. Dak. Extension Circular 73, pp. 3 and 6; Department Circular 356, p. 2.

Q. 2. Describe the outer bark, inner bark, leaves, thorns, flowers, and berries of the common barberry.

A. - The outer bark is grayish in color and is furrowed, the inner bark a bright yellow. The leaves normally are produced in clusters. They always have bristle-toothed edges. The three-pointed thorns occur at the base of the leaf clusters. The flowers are yellow. The berries are green in the summer and red in the fall and winter. They are produced in drooping bunches like currants.

Ref. - N. Dak. Extension Circular 73, pp. 4 and 6; Department Circular 356, p. 2.

Q. 3. Compare the bark, branches, leaves, flower clusters and berries of the common barberry with those of the Japanese or harmless barberry.

A. - The bark of the common barberry is gray and furrowed in comparison with the reddish-brown, smooth bark of the Japanese barberry. The branches of the common barberry grow erect but those of the Japanese barberry are spreading, rarely attaining a height of over four feet. The leaves of the common barberry have bristle-toothed edges; those of the Japanese barberry have smooth edges. The thorns of the Japanese barberry usually occur singly at the base of the leaves. The flower clusters and the berries of the common barberry grow in bunches like currants while on the Japanese barberry the flowers and berries appear singly or in pairs.

Ref. - N. Dak. Extension Circular 73, pp. 4 and 6; Department Circular 356, p. 3.

#### D. Other Methods of Black Stem Rust Control

Q. 1. What effect does the early planting of spring grain have on the control of stem rust?

A. - The early planting of spring grain may help it to mature earlier and thus escape the late epidemics of stem rust.

Q. 2. How can the farmer help the grain to get a good start so that it can ripen before the rust damages it?

A. - Proper crop rotation, proper fertilizers, thorough preparation of the seed bed, early seeding and the use of early and best adapted varieties of grain will aid in the production of a sturdy plant which is less likely to be attacked by rust than weaker plants.

Q. 3. Are there varieties of spring wheat that are more resistant to stem rust than others? What are they?

A. - Most of the varieties of red hard spring common wheat are more susceptible to black stem rust than are the durum wheats. Of the durums, Monad and Nodak are more resistant than Kubanka and Arnautka, the standard varieties. Of the common varieties, Kota and Ceres are more resistant to stem rust than Marquis, the most widely grown variety of spring wheat.

#### E. The Introduction and Distribution of the Common Barberry in the United States.

Q. 1. Is the common barberry native to the United States?

A. - No.

Ref. - N. Dak. Extension Circular 73, p. 3.

Q. 2. Where did the common barberry come from and how has it been distributed throughout the country?

A. - The common barberry is thought to be native to the mountains of middle and western Asia where it was used by man as a medicinal plant. As civilization advanced, the bush was carried either by root or seed wherever the new settlers went. In addition to the use of its leaves and bark for medicinal purposes, the berries have been used in making jellies and wines, and the yellow roots were made into dyes. Later the shrub was used as a hedge fence and for ornamental purposes. For this latter use it was commercialized by nursery companies and sold throughout the United States.

Ref. - N. Dak. Extension Circular 73, p. 3.

Q. 3. Are there any harmful barberries native to North America?

A. - Yes, two species of harmful barberry have been found to be native to North America. Neither of these species is native to North Dakota. One of the native species, called Berberis canadensis, has been found in Illinois, Indiana, and Kentucky and in the Allegheny Mountains. The second species, Berberis fendleri, has been found in Colorado and other Rocky Mountain States.

Q. 4. By what means are the seeds of the common barberry scattered from a seed-bearing bush?

A. - The barberry seeds are scattered principally by birds, but also by cattle and other animals, by man, and by running water.

Ref. - N. Dak. Extension Circular 73, p. 11.

Q. 5. How long do barberry seeds lie in or on the ground before germinating?~ How does this increase the difficulty of barberry eradication?

A. - Barberry seeds have been known to lie in or on the ground for as long as six years before germinating. For this reason several reinspections of properties on which bushes have been destroyed are necessary.

Ref. - N. Dak. Extension Circular 73, p. 12.

#### F. The Eradication of the Common Barberry

Q. 1. Does North Dakota have a law condemning the common barberry?

A. - Yes. This law was passed in 1917. Similar laws are in force in each of the other States in the barberry eradication area.

Ref. - N. Dak. Extension Circular 73, p. 3.

Q. 2. How are common barberry bushes killed?

A. - Common barberry bushes may be killed by digging or by the application of salt or kerosene to the base of the bushes.

Ref. N. Dak. Extension Circular 73, pp. 14 and 15; Department Circular 356, p. 3.

Q. 3. Why is digging often unsatisfactory?

A. - Digging is unsatisfactory because a small root fragment left in the ground may produce sprouts which will spread stem rust.

Ref. - N. Dak. Extension Circular 73, pp. 14 and 15; Department Circular 356, p. 3.

Q. 4. Why is it necessary to revisit properties even after the original barberry bushes have been removed?

A. - Because the seeds may lie in or on the ground for a period of several years before germinating and also because bushes that have been dug very often produce sprouts.

Ref. - N. Dak. Extension Circular 73, p. 14.

Q. 5. Why must care be exercised in placing salt or kerosene on barberry bushes growing in a lawn?

A. - Salt or kerosene placed upon barberry bushes growing in a lawn or hedge also may kill valuable shrubbery or other vegetation within an area of five or six feet. For this reason care must be used in the application of these two chemicals.

Ref. - N. Dak. Extension Circular 73, p. 14; Department Circular 356, p. 4.

Q. 6. If you find a bush which you think is common barberry, to whom would you send a sample for definite identification?

A. - Samples of bushes suspected to be common barberry will be identified free of charge if they are mailed to the Biology Department, State College Station, Fargo, North Dakota.

Q. 7. If you find a bush which you think is common barberry, should you destroy it?

A. - No one should destroy any shrubbery until the sample of it has been properly identified. In this way valuable hedges and shrubbery will not be destroyed by mistake.

### PRACTICAL EXERCISES

Ask the pupils to bring in some of the black stage of the rust which is present on the stubble of most grain fields. Examine the rusted straw under a hand lens or microscope. Notice how the rust has broken through the straw. Scrape some of the black spores from the stem into a drop of water on a glass slide. Place a cover glass on the material and examine under the microscope. Note that the black spores are two-celled. Note their comparatively thick walls. Each cell of a black spore may germinate in the spring and produce the tiny colorless spores which infect the common barberry.

If the red or summer stage of the rust is available, prepare a microscope slide of it. Compare the size, shape and color of these spores with the black spores. Note that the red spores are only one-celled and are oval in shape. Note, too, that the walls on the red spores are thin. It is for this reason that these spores soon dry out or are killed quickly by cold weather.

Have the pupils draw a twig of the common barberry showing the chief characteristics by which the bush may be identified.

Examine a group of cluster cups on a barberry leaf. An average-sized cluster-cup contains from 8,000 to 15,000 spores, so that a moderately-infected common barberry bush six feet high may produce hundreds of millions of black stem-rust spores.

### CORRELATIONS

#### Language

Write a letter asking for bulletins on barberry eradication. Write a letter to some farmer telling him about the relation of the common barberry bush to black stem rust. Have the pupils write sentences containing the words suggested for a spelling lesson.



### Arithmetic

The following figures were obtained by actual counts made on a common barberry bush of medium size:

Total number of leaves - - - - -	35,000
Percentage of leaves showing rust - - - - -	80.
Average number of rust clusters on each infected leaf	3
Average number of cups in each cluster - - - - -	36
Average number of spores in one cup of a cluster - - -	11,500

Q. 1. How many rusted leaves would there be on the average-sized bush?

A. - 28,000.

Q. 2. How many clusters of cluster-cups would there be on the average-sized bush?

A. - 224,000.

Q. 3. How many cluster-cups would there be on each leaf?

A. - 288.

Q. 4. How many cluster-cups would there be on the entire bush?

A. - 8,064,000.

Q. 5. How many spores would be produced on the entire bush?

A. - 92,736,000,000.

Q. 6. If the wind distributed these spores so that one fell on each square inch of land surface, how many acres would the spores from this bush cover?

A. - 14,784 acres.

Q. 7. How many square miles is this?

A. - 23 square miles.

Q. 8. How many barberry bushes would it take to produce one spore for every square inch of land surface in your county?

Q. 9. What is the damage in dollars that has been traced to rust spread from a single common barberry?

A. - The damage traceable to a single bush is very hard to determine because of the long distance which spores may be blown. However, damage to the extent of \$50,000 was definitely traced to a single common barberry in Indiana.

Combined with the following facts, some amazing results may be obtained. A single red rust spot on a grain plant may contain one hundred thousand spores, each capable of causing more rust on the same



or other grain plants. From the time infection occurs until a new crop of spores is formed, about ten days have elapsed. Each of the new spores may repeat the process. In ordinary seasons at least four to six crops of red spores may be produced between the time the barberry begins spreading rust and the time of harvest. Fortunately, many of the spores produced fail to survive.

### Geography

Study the area in which the barberry eradication campaign is being carried on. Where is most of our spring wheat grown? Winter wheat? Give reasons for clearing this area of all common barberry bushes.

### Spelling

barberry	destructive	cooperation	chemical	germinating
eradication	disease	campaign	kerosene	common
destroys	epidemic	yield	average	European
stem rust	damage	weather	production	grain
spore	agriculture	reduced	escaped	sprouts
Japanese	cluster-cup	spine	prevention	resistant
grain	wheat		distribution	bristle-toothed





The following lesson plan has for its basis a general lesson plan prepared by Noel F. Thompson<sup>1</sup> and Donald G. Fletcher<sup>2</sup>. It has been revised and adapted to the needs of Nebraska schools by A. F. Thiel<sup>3</sup>, State Leader of Barberry Eradication in Nebraska.

1. Associate Pathologist, Office of Cereal Crops and Diseases, Bureau of Plant Industry, U. S. Department of Agriculture.
2. Secretary of the Conference for the Prevention of Grain Rust, 300 Lewis Building, Minneapolis, Minnesota.
3. Associate Pathologist, in charge of Barberry Eradication in Nebraska, Office of Cereal Crops and Diseases, U. S. Department of Agriculture.

## LESSON PLAN

A plan by which the teachers of Botany may be aided in presenting the essential facts concerning stem rust and how to check its ravages through the eradication of the common barberry.

### Teacher's Aim:

(1) To become familiar with the common barberry and its relation to stem rust, and (2) to impart this information to the students.

### Student's Aim:

(1) To learn the essential facts concerning the life history and the importance of stem rust; (2) to learn to recognize the common barberry and distinguish it from shrubs, including the Japanese barberry; (3) to learn to recognize the four stages of stem rust; and (4) to disseminate this information in the community.

### POSSIBLE CORRELATIONS

The study of the common barberry may be advantageously included in the study of any or all of the following subjects: Botany, Biology, General Science, Agriculture, and Nature Study.

### DEFINITIONS

Before beginning the study of stem rust the following definitions should be mastered:

**PARASITE:** A living organism, either an animal or a plant, that lives on or in some other organism from which it derives its nourishment for the whole or a part of its existence. It produces no food of its own. A plant parasite, then, is a plant which steals its food from another living plant. Most such parasites are fungi, but not every fungus is a parasite, as some are called saprophytes because they live on dead material.

**FUNGUS:** A fungus is a plant devoid of green coloring matter. Unlike green plants, it does not produce its own food materials, but obtains them from living or dead organic matter. It reproduces usually by means of spores. Examples of fungi: Toadstools, puffballs, bread molds, rusts, smuts, etc.

**SPORE:** A spore is a minute reproductive body or cell. It is well called the seed of a fungus.

**HOST OR HOST PLANT:** Host plant is a term applied to the plant on or in which a parasite lives and from which it steals its food.



**LIFE CYCLE:** The life cycle of a plant or animal is the series of stages through which it passes before completing its full development.

**Examples:** An example of this can be found in the four stages of the life cycle of the butterfly. First, the egg, then the worm, next the pupa, and finally the butterfly. Stem rust furnishes one of the best examples of the life cycle of a parasitic fungus.

#### SOURCES OF INFORMATION

United States Department of Agriculture Farmers' Bulletins 1058 and 1544, and Department Circulars 269 and 356. Nebraska Extension Circular No. 128. First Course in Botany (Text) by Pool and Evans.

#### SUGGESTIONS TO THE TEACHER

The loss of grain in the principal grain-growing areas of the United States from stem rust has increased greatly in the last fifty years somewhat in proportion to the number of common barberry bushes. These bushes were introduced and planted as shrubbery and hedges, but their seeds have been scattered by birds and cattle to waste lands and wooded areas. Almost every farmer who has raised grain has suffered losses from stem rust. Effective control of this disease is of vital interest to American agriculture. It is of especial importance in Nebraska, where so much acreage is devoted to small grains.

Small grains are attacked also by several other plant diseases which in some sections cause severe damage. The diseases most easily confused with stem rust are the leaf rusts of cereals, including crown rust of oats. Where the leaf rusts occur, pupils should be taught to distinguish between the leaf rusts and stem rust, which is the only grain rust spread by the common barberry.

Read the bulletins carefully. Familiarize yourself with the answers to the questions. Allow the pupils to study the material, the bulletins, and the charts, before beginning any discussion on the subject. Divide the study questions into several recitation periods as thought best. Emphasize the identification of the common barberry bush. Have the pupils bring to school samples of any bushes they may believe to be the common barberry, and, if necessary, send the samples to Office of Barberry Eradication, State Agricultural College, Lincoln, Nebraska, for identification. Encourage the pupils to ask their parents about stem rust and the damage it does. Explain carefully the relation of the common barberry to this rust. Point out clearly that the destruction of every common barberry is absolutely necessary for the successful control of stem rust. Encourage the pupils to look for barberry bushes. When one is found, let all the neighbors see it, and then report its location to the Barberry Eradication Office, State Agricultural College, Lincoln, Nebraska.

## A. RELATION OF COMMON BARBERRY TO STEW RUST

Question 1. What is stem rust?

Answer - Stem rust is a fungous parasite which attacks wheat, barley, oats, rye, and many of the tame and wild grasses.

Reference - Nebraska Extension Circular 128, p. 2; U. S. Department of Agriculture Farmers' Bulletin No. 1038, pp. 5 & 6; Department Circular 369, p. 12; Department Circular 356, p. 1.

Q. 2. Explain what and how the kernels are shriveled when rust attacks the plant severely.

A. - The rust attacks the grain plant and robs it of the food which is intended for the development of the kernels. As a result the kernels are undernourished, and shriveled from lack of food.

Q. 3. Name the four stages in the life cycle of stem rust.

A. - The four stages of black stem rust are:

- (1) The colorless-spore stage. Produced in the early spring by germinating black spores. These colorless spores infect only the barberry, producing the cluster-cup stage.
- (2) The yellow cluster-cup or spring-spore stage. Develops only on the barberry bush. Produces yellow spores.
- (3) The red or summer-spore stage. Develops only on grains and grasses. Its reddish-brown spores spread to other grains and grasses and produce a second crop. In like manner, successive crops of summer spores develop about every ten days throughout the summer.
- (4) The black or winter-spore stage. Develops only on grains and grasses. Replaces the summer stage, producing its black spores in the red-spore pustules or in new pustules.

Ref. - Nebraska Extension Circular 128, pp 7 & 8; Farmers' Bulletin 1038, pp. 5 & 6; Department Circular 369, p. 12; Department Circular 356, p. 2; First Course in Botany, following p. 395.

Q. 4. Why will the eradication of the common barberry in Nebraska and adjacent States tend to stop destructive stem-rust epidemics?

A. - Without the common barberry, the black-spore stage which lives over the winter can not infect grains and grasses. The red stage, which can infect grain directly, does not live over winter in this State.

Ref. - Nebraska Extension Circular 128, p. 7.

Q. 5. What effect does favorable, that is, hot, wet weather have on stem rust?

A. - Hot, wet weather speeds up the production of rust spores, which enables the rust to spread rapidly.

Ref. - Nebraska Extension Circular 128, p. 11.

Q. 6. What color is the rust produced on a grain plant after it becomes infected by the spores from a rusted barberry bush?

A. - The first stage of the rust which appears on grain plants is brick red.

Ref. - Nebraska Extension Circular 128, p. 7.

Q. 7. How is rust spread from the barberry to grains and grasses?

A. - The rust is spread from the barberry to grains and grasses by tiny colorless spores carried by the wind. These spores are so small that they cannot be seen with the naked eye.

Q. 8. Can this red rust on the grain plants infect other grain plants? Does stem rust produce one crop, or more than one crop of red spores during the summer? How often may a new crop of red spores be produced if weather conditions are favorable?

A. - Yes, the red rust on the grain plants can infect other grain plants by means of the red spores. Stem rust may produce a number of crops of red spores during the summer, the number depending on weather conditions. Under favorable weather conditions a new crop of red spores may be produced every seven to ten days. Each new spore may infect another plant and thus aid in the spread of rust.

Ref. - Nebraska Extension Circular 128, p. 7; Department Circular 356, p. 2.

Q. 9. Can black spores directly infect grains and grasses?

A. - No, black spores cannot directly infect grains; they are the resting spores by which the rust survives the winter.

Ref. - Nebraska Extension Circular 128, p. 7; Farmers' Bulletin 1058, p. 6; Department Circular 356, p. 2.

Q. 10. Can the black spores directly infect the barberry?

A. - No; the black spores germinate and produce the colorless spores which infect the common barberry.

Ref. - Nebraska Extension Circular 128, p. 7; Department Circular 356, p. 2.

Q. 11. Do all kinds of barberries spread stem rust?

A. - No. The Japanese barberry does not spread stem rust.

Ref. - Nebraska Extension Circular 128, p. 12; Department Circular 356, p. 3.

Q. 12. What is one of the best methods of reducing stem-rust losses?

A. - The eradication of the common barberry is one of the best methods of reducing stem-rust losses in both the northern United States and many foreign countries, because the red spores do not live through the winter in the northern States, and because the black spores and the colorless spores are harmless without the barberry.

Ref. - Nebraska Extension Circular 128, pp. 9 & 10; Farmers' Bulletin 1058, pp. 5, 6 & 7; Department Circular 269.

Q. 13. Would the eradication of all the common barberries on one farm protect the grain on that farm from stem rust?

A. - No; because spores of stem rust may be blown from barberries or rusted grain on other farms. Rust spores, being very small, may be carried by the slightest breeze.

Q. 14. Could the barberries in the neighboring States produce rust which might spread to the grain in this State?

A. - Yes, under favorable weather conditions it is very likely that spores from barberry bushes in one State could be blown into another State and cause rust infections.

Q. 15. What have other countries done to control stem rust?

A. - Several foreign countries, notably Denmark, have passed laws compelling the destruction of the common barberry. In each of these countries serious damage from black stem rust no longer occurs.

#### B. LOSSES CAUSED BY STEM RUST

Q. 1. Why is the market value of shriveled grain greatly reduced? (Compare a sample of rust-shriveled grain with a sample of plump grain which has not been damaged by rust.)

A. - Shriveled grain is not as heavy as the plump grain, and its value is also reduced by the fact that it is not well suited for milling purposes.

Go to your local elevator and inquire the market price of wheat weighing 58 pounds to the bushel and wheat weighing 48 pounds to the bushel. (That that has been attacked by rust very often weighs ten or more pounds less than wheat which has been free from rust and other disease.)

Q.2. What is the average annual stem-rust loss in the United States? In Nebraska?

A. - The average stem-rust loss to small grains in the United States is estimated at nearly \$60,000,000 annually for the 12-year period 1915 to 1926, inclusive. In Nebraska alone in the same period the average annual loss is estimated at about \$2,900,000.

Ref. - Nebraska Extension Circular 128, p. 3.

Q. 3. Has barberry eradication reduced stem-rust losses in Nebraska?

A. - Yes. Although the campaign to remove all of the barberries is far from completed, the eradication of 127,604 barberries from 4,013 properties has eliminated just that many potential sources of rust.

### C. IDENTIFICATION OF COMMON BARBERRY

Q. 1. Describe the appearance of the common barberry bush as to shape and size.

A. - The common barberry is an erect shrub of graceful habit. It ranges from a seedling bush of a few inches to a mature shrub of possibly twelve or more feet. The color of the leaves is a dull green. There also is a variety of the common barberry which has purple leaves.

Ref. - Nebraska Extension Circular 128, p. 12; Department Circular 356, p. 2.

Q. 2. Describe the outer bark, inner bark, leaves, thorns, flowers, and berries of the common barberry.

A. - The outer bark is grayish in color and is furrowed, the inner bark a bright yellow. The leaves normally are produced in clusters. They always have bristle-toothed edges. The three-pointed thorns occur at the base of the leaf clusters. The flowers are yellow. The berries are green in the summer and red in the fall and winter. They are produced in drooping bunches like currants.

Ref. - Nebraska Extension Circular 128, pp. 11 & 12; Department Circular 356, p. 2; First Course in Botany, following p. 397.

Q. 3. Compare the bark, branches, leaves, flower clusters, and berries of the common barberry with those of the Japanese or harmless barberry.

A. - The bark of the common barberry is gray and furrowed, in comparison with the reddish-brown, smooth bark of the Japanese barberry. The branches of the common barberry grow erect, but those of the Japanese barberry are spreading, rarely attaining a height of over four feet. The leaves of the common barberry have bristle-toothed edges; those of the Japanese barberry have smooth edges. The thorns of the Japanese barberry usually occur singly at the base of the leaves. The flower clusters and the berries of the common barberry grow in bunches like currants, while on the Japanese barberry the flowers and berries appear singly or in pairs.

Ref. - Nebraska Extension Circular 128, pp 11 & 12; Department Circular 356, p. 3.



D. INTRODUCTION AND DISTRIBUTION OF THE  
COMMON BARBERRY IN THE UNITED STATES.

Q. 1. Is the common barberry native to the United States?

A. - No.

Q. 2. Where did the common barberry come from, and how has it been distributed throughout the country?

A. - The common barberry is thought to be native to the mountains of middle and western Asia, where it was used by man as a medicinal plant. As civilization advanced, the bush was carried by either root or seed wherever the new settlers went. In addition to the use of its leaves and bark for medicinal purposes, the berries have been used in making jellies and wines, and the yellow roots were made into dyes. Later the shrub was used as a hedge fence and for ornamental purposes. For this latter use it was commercialized by nursery companies and sold throughout the United States.

Q. 3. Are there any harmful barberries native to North America?

A. - Yes, two species of harmful barberry have been found to be native to North America. Neither of these species is native to Nebraska. One of the native species, called Barb. canadensis, have been found in Illinois, Indiana, and Kentucky and in the Allegheny Mountains. The second species, Barb. fendleri, has been found in Colorado. Mahonia aquifolium and Mahonia repens, both commonly called Oregon grape, are closely related to the common barberry and are native to Montana. Mahonia aquifolium has been found only on the western slope of the Rocky Mountains, but Mahonia repens is generally distributed throughout the mountainous region of Montana. Neither of these, however, has ever been found infected with stem rust in its natural habitat. Mahonia aquifolium has been infected artificially.

Ref. - Department Circular 356, p. 3.

Q. 4. By what means are the seeds of the common barberry scattered from a seed-bearing bush?

A. - The barberry seeds are scattered principally by birds, but also by cattle and other animals, by man, and by running water.

Ref. - Nebraska Extension Circular 131, pp. 13 & 14.

Q. 5. How long do barberry seeds lie in or on the ground before germinating? How does this increase the difficulty of barberry eradication?

A. - Barberry seeds have been known to lie in or on the ground for as long as six years before germinating. For this reason several re-inspections of properties on which bushes have been destroyed are necessary.

#### E. ERADICATION OF THE COMMON BARBERRY

Q. 1. Does Nebraska have a law condemning the common barberry?

A. - Yes. The law was passed in April 1919. Similar laws are in force in each of the other States in the barberry eradication area.

Q. 2. How are common barberry bushes killed?

A. - Common barberry bushes may be killed by digging or by the application of salt or kerosene to the base of the bushes.

Ref. - Nebraska Extension Circular 128, p. 14; Department Circular 356, p. 3.

Q. 3. Why is digging often unsatisfactory?

A. - Digging is unsatisfactory because a small root fragment left in the ground may produce sprouts which will spread stem rust.

Ref. - Nebraska Extension Circular 128, p. 14; Department Circular 356, p. 3.

Q. 4. Why is it necessary to revisit properties even after the original barberry bushes have been removed.

A. - Because the seeds may lie in or on the ground for a period of several years before germinating, and also because bushes that have been dug very often produce sprouts.

Q. 5. Why must care be exercised in placing salt or kerosene on barberry bushes growing in a lawn?

A. - Salt or kerosene placed upon barberry bushes growing in a lawn or hedge also may kill valuable shrubbery or other vegetation within an area of five or six feet. For this reason care must be used in the application of these two chemicals.

Ref. - Nebraska Extension Circular 128, pp. 14 & 15; Department Circular 356, p. 4.

Q. 6. If you find a bush which you think is common barberry, to whom would you send a sample for definite identification?

A. - Samples of bushes suspected to be common barberry will be identified free of charge if they are mailed to the Office of Barberry Eradication, State Agricultural College, Lincoln, Nebraska.

Q. 7. If you find a bush which you think is common barberry, should you destroy it?

A. - No one should destroy any shrubbery until a sample of it has been properly identified. In this way valuable hedges and shrubbery will not be destroyed by mistake.

### PRACTICAL EXERCISES

Ask the pupils to bring in some of the black rust of the fruit, which is present on the stubble of most grain fields. Examine the rusted straw under a hand lens or a microscope. Notice how the rust has broken through the straw. Grind some of the black spores from the straw into a drop of water on a glass slide. If you cover glass on the material and examine under the microscope, note that the black spores are two-celled. Note their comparatively thick walls. Each cell of a black spore may germinate in the spring and produce the tiny colorless spores which infect the common barberry.

If the red or summer stage of the rust is available, prepare a microscope slide of it. Compare the size, shape, and color of these spores with the black spores. Note that the red spores are only one-celled and are oval in shape. Note, too, that the walls on the red spores are thin. It is for this reason that these spores soon dry out or are killed quickly by cold weather.

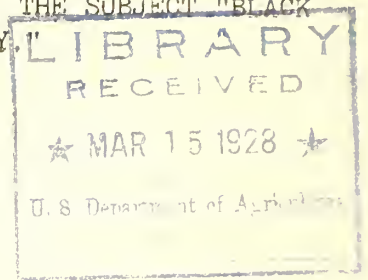
Have pupils draw a twig of the common barberry showing the chief characteristics by which the bush may be identified.

Have each pupil survey his own home property for barberries.

Combine a survey for barberries with other field trips.



Blp  
A LESSON PLAN BY WHICH NORTH DAKOTA TEACHERS MAY PRESENT THE SUBJECT "BLACK  
STEM RUST AND THE COMMON BARBERRY."



To the teachers of North Dakota:

The enclosed lesson plan for the teaching of the story of the common barberry and its relation to the spread of black stem rust of grains has my approval and endorsement.

Very sincerely yours,

BERTHA R. PALMER

Bertha R. Palmer, Superintendent,  
Department of Public Instruction.

Furnished to the schools of North Dakota by the Office of Cereal Crops and Diseases, Bureau of Plant Industry, United States Department of Agriculture, in cooperation with the State Agricultural College, Fargo, North Dakota, the Conference for the Prevention of Grain Rust, 300 Lewis Building, Minneapolis, Minnesota, and the State Department of Public Instruction, Bismarck, North Dakota.



The following lesson plan has as its basis a general lesson plan prepared by Donald G. Fletcher, and Noel F. Thompson.. It has been revised and adapted to the needs of North Dakota schools by George C. Mayoue, and Edward M. Yocum, with the aid of the following State Officials and educators:

Miss Bertha R. Palmer, State Superintendent of Public Instruction in North Dakota.

President George A. McFarland of the Minot State Teachers College.

Miss Elsie J. Cook, critic of the Minot State Teachers College, and President of the North Dakota Parent-Teachers Association.

1. Secretary of the Conference for the Prevention of Grain Rust, 300 Lewis Building, Minneapolis, Minnesota.
2. Associate Pathologist, Office of Cereal Crops and Diseases, Bureau of Plant Industry, U. S. Department of Agriculture.
3. Associate Pathologist in Charge of Barberry Eradication in North Dakota.
4. Agent, Office of Cereal Crops and Diseases, U. S. Department of Agriculture.

## LESSON PLAN

A plan by which the teachers of North Dakota may be guided in presenting the essential facts concerning stem rust and its prevention through the eradication of the common barberry.

### Teacher's Aim:

(1) To become familiar with the common barberry and its relation to black stem rust, and (2) to impart this information to the students.

### Student's Aim:

(1) To learn the essential facts concerning the life history and the importance of black stem rust; (2) To learn to recognize the common barberry and distinguish it from other shrubs, including the Japanese barberry; (3) To learn to recognize the four stages of stem rust; and (4) To disseminate this information in the community.

### Possible Correlations

The study of the common barberry may be advantageously included in the study of any or all of the following subjects: Botany, Biology, Agriculture, General Science, Nature study, Language, Arithmetic, Geography, and Spelling.

### Definitions

Before beginning the study of black stem rust the following definitions should be mastered:

**PARASITE:** A living organism, either an animal or a plant, that lives on or in some other organism from which it derives its nourishment for the whole or a part of its existence. It produces no food of its own. A plant parasite, then, is a plant which steals its food from another living plant. Most such parasites are fungi, but not every fungus is a parasite as some are called saprophytes because they live on dead material.

**FUNGUS:** A fungus is a plant devoid of green coloring matter. Unlike green plants, it does not produce its own food materials, but obtains them from living or dead organic matter. It reproduces usually by means of spores. Examples of fungi: Toadstools, puffballs, bread molds, smuts, rusts, etc.

**SPORE:** A spore is a minute reproductive body or cell. It might very well be called the seed of a fungus.

**HOST or HOST PLANT:** Host plant is a term applied to the plant on or in which a parasite lives and from which it gets its food.

**LIFE CYCLE:** The life cycle of a plant or animal is the series of stages thru which it passes before completing its full development.

Examples: An example of this can be found in the four stages of the life cycle of the butterfly. First, the egg, then the worm, next, the pupa, and finally, the butterfly. Black stem rust furnishes one of the best examples of the life cycle of a parasitic fungus.

### Sources of Information

United States Department of Agriculture Farmers' Bulletin 1053, and Department Circulars 269 and 356. North Dakota Extension Circular No. 73. Pamphlets prepared by the Conference for the Prevention of Grain Rust, 300 Lewis Building, Minneapolis, Minnesota, an agency cooperating with the United States Department of Agriculture and the States.

### Suggestions to the Teacher

The loss of grain in the principal grain-growing areas of the United States from black stem rust has increased greatly in the past fifty years somewhat in proportion to the number of common barberry bushes. These bushes were introduced and planted as shrubbery and hedges but their seeds have been scattered by birds and cattle to waste lands and wooded areas. Almost every farmer who has raised grain has suffered losses from black stem rust. Effective control of this disease is of vital interest to American agriculture. It is of especial importance in North Dakota where so much spring wheat is grown.

Small grains are attacked also by several other plant diseases which in some sections cause severe damage. The diseases most easily confused with stem rust are the leaf rusts of cereals, including crown rust of oats. Where the leaf rusts occur, pupils should be taught to distinguish between the leaf rusts and black stem rust, which is the only grain rust spread by the common barberry.

Read the bulletins carefully. Familiarize yourself with the answers to the questions. Allow the pupils to study the material, the bulletins, and the charts, before beginning any discussion on the subject. Divide the study questions into several recitation periods as thought best. Emphasize the identification of the common barberry bush. Have the pupils bring to school samples of any bushes they may believe to be the common barberry and, if necessary, send the samples to the Biology Department, State Agricultural College, Fargo, North Dakota, for identification. Encourage the pupils to ask their parents about black stem rust and the damage it does. Explain carefully the relation of the common barberry to this rust. Point out clearly that the destruction of every common barberry is absolutely necessary for the successful control of black stem rust. Encourage the pupils to look for barberry bushes. When one is found, let all the neighbors see it and then report its location to the Barberry Eradication Office, State Agricultural College, Fargo, North Dakota.

## A. Relation of Common Barberry to Black Stem Rust

Question 1. What is black stem rust?

Answer - Black stem rust is a fungous parasite which attacks wheat, barley, oats, rye and many of the tame and wild grasses.

Reference - N. Dak. Extension Circular No. 73, p. 5; U. S. Department of Agriculture Farmers' Bulletin No. 1058, pp. 5 & 6; Department Circular 269, p. 12; Department Circular 356, p. 1.

Q. 2. Explain why and how the kernels are shriveled when rust attacks the plant severely.

A. - The rust attacks the grain plant and robs it of the food which is intended for the development of the kernels. As a result these kernels are under-nourished, and shriveled from lack of food.

Ref. - N. Dak. Extension Circular 73, p.8.

Q. 3. Name the four stages in the life cycle of stem rust.

A. - The four stages of black stem rust are:

(1) The yellow cluster-cup or spring-spore stage. Develops only on the barberry bush. Produces yellow spores.

(2) The red or summer-spore stage. Develops only on grains and grasses. Its reddish-brown spores spread to other grains and grasses and produce a second crop. In like manner, successive crops of summer spores develop about every ten days throughout the summer.

(3) The black or winter-spore stage. Develops only on grains and grasses. Follows the summer stage, producing its black spores in the red-spore pustules or in new pustules.

(4) The colorless-spore stage. Produced in the early spring by germinating black spores. These colorless spores infect only the barberry, producing the cluster-cup stage.

Ref. - N.Dak. Extension Circular 73, p. 5; Farmers' Bulletin 1058, pp. 5 & 6; Department Circular 269, p. 12; Department Circular 356, p. 2.

Q. 4. Why will the eradication of the common barberry in North Dakota and adjacent States tend to stop destructive stem-rust epidemics?

A. - Without the common barberry, the black-spore stage which lives over the winter can not infect grains and grasses. The red stage, which can infect grain directly, does not live over winter in these States.

Ref. - N.Dak. Extension Circular 73, p. 6.

Q. 5. What effect does hot, wet weather have on black stem rust?

A. - Hot, wet weather speeds up the production of rust spores which enables the rust to spread rapidly.

Ref. - N. Dak. Extension Circular 73, p. 7.

Q. 6. What color is the rust produced on a grain plant after it becomes infected by the spores from a rusted barberry bush?

A. - The first stage of the rust which appears on grain plants is brick red.

Ref. - N. Dak. Extension Circular 73, p. 7.



Q. 7. How is rust spread from the barberry to grains and grasses?

A. - The rust is spread from the barberry to grains and grasses by tiny spores carried by the wind. These spores are so small that they can not be seen with the naked eye.

Ref. - N. Dak. Extension Circular 73, p. 7.

Q. 8. Can this red rust on the grain plants infect other grain plants? Does stem rust produce one crop or more than one crop of red spores during the summer? How often may a new crop of red spores be produced if weather conditions are favorable?

A. - Yes, the red rust on the grain plants can infect other grain plants by means of the red spores. Stem rust may produce a number of crops of red spores during the summer, the number depending on weather conditions. Under favorable weather conditions a new crop of red spores may be produced every seven to ten days. Each new spore may infect another plant and thus aid in the spread of rust.

Ref. - N. Dak. Extension Circular 73, pp. 6 & 7.

Q. 9. Can black spores directly infect grains and grasses?

A. - No, black spores can not directly infect grains, they are the resting spores by which the rust survives the winter.

Ref. - N. Dak. Extension Circular 73, pp. 6 & 16; Farmers' Bulletin 1058, p. 6.

Q. 10. Can the black spores directly infect the barberry?

A. - No, the black spores germinate and produce the colorless spores which infect the common barberry.

Ref. - Department Circular 356, p. 2.

Q. 11. What are the only plants that can be infected by the colorless spores of black stem rust?

A. - Only some plants belonging to the Barberry family.

Ref. - N. Dak. Extension Circular 73, p. 6; Farmers' Bulletin 1058, pp. 5 & 6.

Q. 12. Do all kinds of barberries spread black stem rust?

A. - No. The Japanese barberry does not spread stem rust.

Ref. - N. Dak. Extension Circular 73, p. 5.

Q. 13. What is one of the best methods of controlling black stem rust?

A. - The eradication of the common barberry is one of the best methods of controlling stem rust in both the northern United States and many foreign countries because the red spores do not live through the winter in the northern States, and because the black spores and the colorless spores are harmless without the barberry.

Ref. - N. Dak. Extension Circular 73, p. 8; Farmers' Bulletin 1058, pp. 5, 6, & 7; Department Circular 269.



Q. 14. Would the eradication of all the common barberries on one farm protect the grain on that farm from black stem rust?

A. - No; because spores of stem rust may be blown from barberries or rusted grain on other farms. Rust spores, being very small, may be carried by the slightest breeze.

Ref. - General information from all bulletins.

Q. 15. Could the barberries in the neighboring States produce rust which might spread to the grain in this State?

A. - Yes, under favorable weather conditions it is very likely that spores from barberry bushes in one State could be blown into another State and cause rust infections.

Q. 16. What have other countries done to control black stem rust?

A. - Several foreign countries, notably Denmark, have passed laws compelling the destruction of the common barberry. In each of these countries serious damage from black stem rust no longer occurs.

### B. Losses Caused by Black Stem Rust

Q. 1. Why is the market value of shriveled grain greatly reduced? (Compare a sample of rust-shriveled grain with a sample of plump grain which has not been damaged by rust.)

A. - Shriveled grain is not as heavy as the plump grain and its value is also reduced by the fact that it is not well suited for milling purposes.

Go to your local elevator and inquire the market price of wheat weighing 58 pounds to the bushel and wheat weighing 48 pounds to the bushel. (Wheat that has been attacked by rust very often weighs ten or more pounds less than wheat which has been free from rust and other diseases.)

Q. 2. What is the average annual stem-rust loss in the United States? In North Dakota?

A. - The average stem-rust loss to small grains in the United States is estimated at nearly 50,000,000 bushels annually for the 12-year period 1915 to 1926, inclusive. In North Dakota alone in the same period the average annual loss is estimated at about 19,000,000 bushels.

Ref. - N. Dak. Extension Circular 73, p. 16.

Q. 3. Has barberry eradication reduced stem-rust losses in North Dakota?

A. - Yes. Although the campaign to remove all of the barberries is far from completed, stem-rust epidemics have become less severe and the general annual occurrence of stem rust has been considerably later.

### C. Identification of Common Barberry

Q. 1. Describe the appearance of the common barberry bush as to shape and size.

A. - The common barberry is an erect shrub of graceful habit. It ranges from a seedling bush of a few inches to a mature shrub of possibly twelve or more feet. The color of the leaves is a dull green. There also is a variety of the common barberry which has purple leaves.

Ref. - N. Dak. Extension Circular 73, pp. 3 and 6; Department Circular 356, p. 2.

Q. 2. Describe the outer bark, inner bark, leaves, thorns, flowers, and berries of the common barberry.

A. - The outer bark is grayish in color and is furrowed, the inner bark a bright yellow. The leaves normally are produced in clusters. They always have bristle-toothed edges. The three-pointed thorns occur at the base of the leaf clusters. The flowers are yellow. The berries are green in the summer and red in the fall and winter. They are produced in drooping bunches like currants.

Ref. - N. Dak. Extension Circular 73, pp. 4 and 6; Department Circular 356, p. 2.

Q. 3. Compare the bark, branches, leaves, flower clusters and berries of the common barberry with those of the Japanese or harmless barberry.

A. - The bark of the common barberry is gray and furrowed in comparison with the reddish-brown, smooth bark of the Japanese barberry. The branches of the common barberry grow erect but those of the Japanese barberry are spreading, rarely attaining a height of over four feet. The leaves of the common barberry have bristle-toothed edges; those of the Japanese barberry have smooth edges. The thorns of the Japanese barberry usually occur singly at the base of the leaves. The flower clusters and the berries of the common barberry grow in bunches like currants while on the Japanese barberry the flowers and berries appear singly or in pairs.

Ref. - N. Dak. Extension Circular 73, pp. 4 and 6; Department Circular 356, p. 3.

#### D. Other Methods of Black Stem Rust Control

Q. 1. What effect does the early planting of spring grain have on the control of stem rust?

A. - The early planting of spring grain may help it to mature earlier and thus escape the late epidemics of stem rust.

Q. 2. How can the farmer help the grain to get a good start so that it can ripen before the rust damages it?

A. - Proper crop rotation, proper fertilizers, thorough preparation of the seed bed, early seeding and the use of early and best adapted varieties of grain will aid in the production of a sturdy plant which is less likely to be attacked by rust than weaker plants.

Q. 3. Are there varieties of spring wheat that are more resistant to stem rust than others? What are they?

A. - Most of the varieties of red hard spring common wheat are more susceptible to black stem rust than are the durum wheats. Of the durum, Monad and Nodak are more resistant than Kubanka and Arnautka, the standard varieties. Of the common varieties, Kota and Ceres are more resistant to stem rust than Marquis, the most widely grown variety of spring wheat.

E. The Introduction and Distribution of the  
Common Barberry in the United States.

Q. 1. Is the common barberry native to the United States?

A. - No.

Ref. - N. Dak. Extension Circular 73, p. 3.

Q. 2. Where did the common barberry come from and how has it been distributed throughout the country?

A. - The common barberry is thought to be native to the mountains of middle and western Asia where it was used by man as a medicinal plant. As civilization advanced, the bush was carried either by root or seed wherever the new settlers went. In addition to the use of its leaves and bark for medicinal purposes, the berries have been used in making jellies and wines, and the yellow roots were made into dyes. Later the shrub was used as a hedge fence and for ornamental purposes. For this latter use it was commercialized by nursery companies and sold throughout the United States.

Ref. - N. Dak. Extension Circular 73, p. 3.

Q. 3. Are there any harmful barberries native to North America?

A. - Yes, two species of harmful barberry have been found to be native to North America. Neither of these species is native to North Dakota. One of the native species, called Berberis canadensis, has been found in Illinois, Indiana, and Kentucky and in the Allegheny Mountains. The second species, Berberis fendleri, has been found in Colorado and other Rocky Mountain States.

Q. 4. By what means are the seeds of the common barberry scattered from a seed-bearing bush?

A. - The barberry seeds are scattered principally by birds, but also by cattle and other animals, by man, and by running water.

Ref. - N. Dak. Extension Circular 73, p. 11.

Q. 5. How long do barberry seeds lie in or on the ground before germinating? How does this increase the difficulty of barberry eradication?

A. - Barberry seeds have been known to lie in or on the ground for as long as six years before germinating. For this reason several reinspections of properties on which bushes have been destroyed are necessary.

Ref. - N. Dak. Extension Circular 73, p. 12.

F. The Eradication of the Common Barberry

Q. 1. Does North Dakota have a law condemning the common barberry?

A. - Yes. This law was passed in 1917. Similar laws are in force in each of the other States in the barberry eradication area.

Ref. - N. Dak. Extension Circular 73, p. 3.

Q. 2. How are common barberry bushes killed?

A. - Common barberry bushes may be killed by digging or by the application of salt or kerosene to the base of the bushes.

Ref. N. Dak. Extension Circular 73, pp. 14 and 15; Department Circular 356, p. 3.



Q. 3. Why is digging often unsatisfactory?

A. - Digging is unsatisfactory because a small root fragment left in the ground may produce sprouts which will spread stem rust.

Ref. - N. Dak. Extension Circular 73, pp. 14 and 15; Department Circular 356, p. 3.

Q. 4. Why is it necessary to revisit properties even after the original barberry bushes have been removed?

A. - Because the seeds may lie in or on the ground for a period of several years before germinating and also because bushes that have been dug very often produce sprouts.

Ref. - N. Dak. Extension Circular 73, p. 14.

Q. 5. Why must care be exercised in placing salt or kerosene on barberry bushes growing in a lawn?

A. - Salt or kerosene placed upon barberry bushes growing in a lawn or hedge also may kill valuable shrubbery or other vegetation within an area of five or six feet. For this reason care must be used in the application of these two chemicals.

Ref. - N. Dak. Extension Circular 73, p. 14; Department Circular 356, p. 4.

Q. 6. If you find a bush which you think is common barberry, to whom would you send a sample for definite identification?

A. - Samples of bushes suspected to be common barberry will be identified free of charge if they are mailed to the Biology Department, State College Station, Fargo, North Dakota.

Q. 7. If you find a bush which you think is common barberry, should you destroy it?

A. - No one should destroy any shrubbery until the sample of it has been properly identified. In this way valuable hedges and shrubbery will not be destroyed by mistake.

### PRACTICAL EXERCISES

Ask the pupils to bring in some of the black stage of the rust which is present on the stubble of most grain fields. Examine the rusted straw under a hand lens or microscope. Notice how the rust has broken through the straw. Scrape some of the black spores from the stem into a drop of water on a glass slide. Place a cover glass on the material and examine under the microscope. Note that the black spores are two-celled. Note their comparatively thick walls. Each cell of a black spore may germinate in the spring and produce the tiny colorless spores which infect the common barberry.

If the red or summer stage of the rust is available, prepare a microscope slide of it. Compare the size, shape and color of these spores with the black spores. Note that the red spores are only one-celled and are oval in shape. Note, too, that the walls on the red spores are thin. It is for this reason that these spores soon dry out or are killed quickly by cold weather.

Have the pupils draw a twig of the common barberry showing the chief characteristics by which the bush may be identified.

Examine a group of cluster cups on a barberry leaf. An average-sized cluster-cup contains from 8,000 to 15,000 spores, so that a moderately-infected common barberry bush six feet high may produce hundreds of millions of black stem-rust spores.

### CORRELATIONS

#### Language

Write a letter asking for bulletins on barberry eradication. Write a letter to some farmer telling him about the relation of the common barberry bush to black stem rust. Have the pupils write sentences containing the words suggested for a spelling lesson.

#### Arithmetic

The following figures were obtained by actual counts made on a common barberry bush of medium size:

Total number of leaves.....	35,000
Percentage of leaves showing rust.....	80
Average number of rust clusters on each infected leaf..	8
Average number of cups in each cluster.....	36
Average number of spores in one cup of a cluster.....	11,500

- Q. 1. How many rusted leaves would there be on the average-sized bush?  
A. - 28,000.
- Q. 2. How many clusters of cluster-cups would there be on the average-sized bush?  
A. - 224,000.
- Q. 3. How many cluster-cups would there be on each leaf?  
A. - 288.
- Q. 4. How many cluster-cups would there be on the entire bush?  
A. - 8,064,000.
- Q. 5. How many spores would be produced on the entire bush?  
A. - 92,736,000,000.
- Q. 6. If the wind distributed these spores so that one fell on each square inch of land surface, how many acres would the spores from this bush cover?  
A. - 14,784 acres.
- Q. 7. How many square miles is this?  
A. - 23 square miles.



Q. 8. How many barberry bushes would it take to produce one spore for every square inch of land surface in your county?

Q. 9. What is the damage in dollars that has been traced to rust spread from a single common barberry?

A. - The damage traceable to a single bush is very hard to determine because of the long distance which spores may be blown. However, damage to the extent of \$50,000 was definitely traced to a single common barberry in Indiana.

Combined with the following facts, some amazing results may be obtained. A single red rust spot on a grain plant may contain one hundred thousand spores, each capable of causing more rust on the same or other grain plants. From the time infection occurs until a new crop of spores is formed, about ten days have elapsed. Each of the new spores may repeat the process. In ordinary seasons at least four to six crops of red spores may be produced between the time the barberry begins spreading rust and the time of harvest. Fortunately, many of the spores produced fail to survive.

### Geography

Study the area in which the barberry eradication campaign is being carried on. Where is most of our spring wheat grown? Winter wheat? Give reasons for clearing this area of all common barberry bushes.

### Spelling

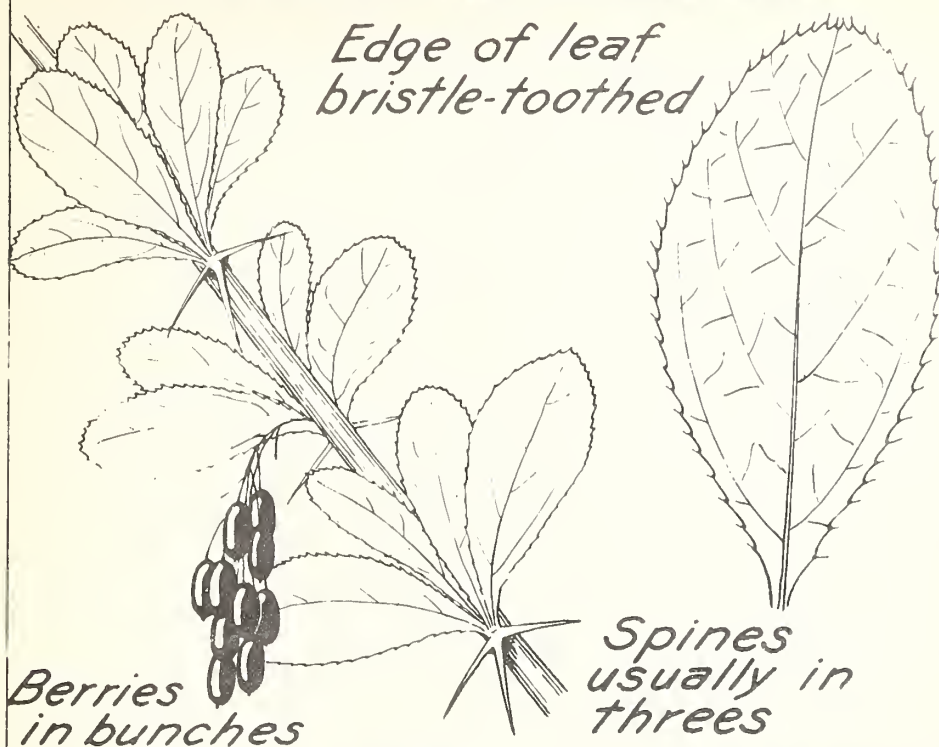
barberry	destructive	cooperation	chemical	germinating
eradication	disease	campaign	kerosene	common
destroys	epidemic	yield	average	European
stem rust	damage	weather	production	grain
spore	agriculture	reduced	escaped	sprouts
Japanese	cluster-cup	spine	prevention	resistant
furrowed	wheat	inoculum	distribution	bristle-toothed

### Single Word Answer Test

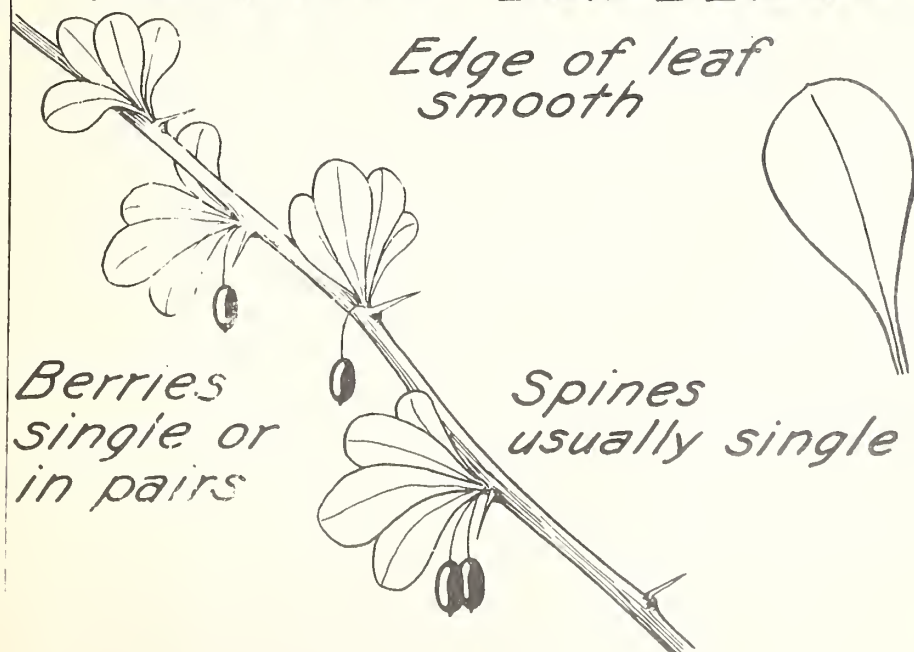
Directions: Write one word as an answer to each of the following questions.

1. What type of food plants does black stem rust attack? Ans. Grain.
2. How many kinds of grain are attacked? Ans. Four.
3. What stage of black stem rust lives through the winter? Ans. Black.
4. What stage of black stem rust occurs on the barberry? Ans. Cluster-cup.
5. What stage of stem rust spreads from field to field? Ans. Red (or summer).
6. What kind of barberry spreads stem rust? Ans. Common.
7. What is the nature of the edges of its leaves? Ans. Bristle-toothed.
8. What kind of a plant is common barberry. -tree, shrub, or herb? Ans. Shrub
9. What other kind of barberry is commonly grown? Ans. Japanese.
10. What common chemical is effective for killing common barberry? Ans. Salt.

## COMMON BARBERRY



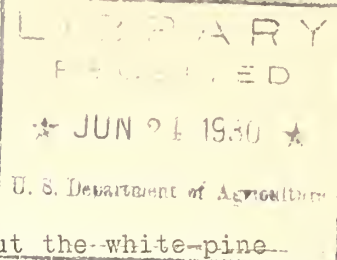
## JAPANESE BARBERRY





6972P

NOTES FOR THE TEACHER ON LESSON PLANS.



The accompanying material tells something about the white-pine blister rust. If you desire more blister rust or forestry information, ask for it on the report sheet, under "Remarks."

There are a number of ways in which the teacher may make use of this project in school work. Here are a few suggestions:

(a) Nature study: Distinguishing white pine and the various currants and gooseberries.

(b) Combine this work with the English work of the class by requiring written and oral reports on the pupils' activities.

(c) Make a map of the school district locating on it places where currants were examined.

(d) Correlate with the English by having pupils write letters to the Minnesota Forest Service, Old State Capitol, St. Paul, Minnesota, for more printed material relative to blister rust.

(e) Correlate with geography by having pupils study the distribution of white pine and white-pine blister rust in Minnesota and the United States.

(f) Make posters and exhibits asking for cooperation in the eradication of wild currants and gooseberries, showing the life history of the disease, etc.

All currants and gooseberries, wild and cultivated, are hosts for blister rust. The common cultivated black currant is the most susceptible to the disease. The garden types of currants and gooseberries may be distinguished as follows:

1. Gooseberries.....the thorns are characteristic.
2. Red Currants.....lobes of leaves somewhat rounded, fruit red, no strong odor.
3. White Currants.....same as red, except that fruit is white or yellowish.
4. Black Currants.....leaves with pointed lobes like a maple leaf; fruit dead black when ripe; foliage with strong odor when crushed; having tiny amber dots on the under sides.
5. Flowering Currants used as a shrub on lawns and around houses; fruit black when ripe; fruit not used much to eat, plant usually tall with gray-green, small, and somewhat deeply cut leaves.

Look for infection in the center of the bushes. The leaves in the center of the bush are protected from the sun and wind, therefore, moisture conditions are more favorable for the development of the rust.

#### INSTRUCTIONS FOR TEACHER

Teachers and pupils can aid us greatly in obtaining information as to the distribution of blister rust in Minnesota. The following instructions tell you how:

(1) Find out which pupils have gooseberries or currants at home and give to those pupils the small envelopes and the colored cards with directions. If any of the pupils have black currants, be especially sure to see that they get cards. If there are not enough cards to go around, one group of pupils may use the cards and then hand them to another group.

(2) Collect envelopes brought in with specimens; see that each has the name and address of the pupil collecting it; and put them in the return envelope.

(3) Fill in the report form with the six blank spaces.

(4) The specimens and report form should be placed in the return envelope and mailed before October 1st. No postage is needed.

The U. S. Department of Agriculture and the Minnesota Forest Service are most grateful for your help and interest in the matter.

Sincerely yours,

L. B. Ritter,  
Agent.



UNITED STATES DEPARTMENT OF AGRICULTURE  
BUREAU OF PLANT INDUSTRY  
AND  
MINNESOTA COMMISSIONER OF FORESTRY & FIRE PREVENTION  
COOPERATING

WHITE-PINE BLISTER RUST CONTROL

To the Teacher:-

THE PROBLEM

The forests of Minnesota are one of its greatest natural resources. They produce wood, which we use in some form every day of our lives. They help to regulate the flow of streams and conserve the water supply. They also add beauty to the country and have an immense recreational value. For these reasons, the forests should be used wisely and protected from fire, insects and diseases.

White pine is one of our most important timber trees. It grows rapidly, produces excellent timber and the wood is easily worked. In recent years, this tree has been threatened by a serious disease known as the white-pine blister rust. Blister rust can be controlled and it is our problem to learn about the disease and how to prevent it from destroying the white pines.

THE FACTS

White pine is, and will continue to be, an important forest tree in Minnesota. White-pine blister rust, if uncontrolled, will interfere with the profitable growing of white pine in this state.

MATERIAL FOR LESSONS

The aim of this lesson is to study the life cycle (life history) of the white-pine blister rust and to learn the best methods used in its control.

REFERENCE MATERIAL

1. White-Pine Blister Rust Control:: State Forest Service.
2. Black Currant Spreads White-Pine Blister Rust:: Misc. Publication #27, U.S. Dept. of Agriculture.

3. Protect White Pine from Blister Rust:: (Leaflet) U. S. Dept. of Agriculture.

4. Forestry Through the Camera:: Minnesota Forest Service

#### SUGGESTED QUESTIONS AND ANSWERS

1. What is white-pine blister rust?

White-pine blister rust is a fungus that attacks the bark of white pine trees and the leaves of currant and gooseberry plants.

2. What is a fungus?

A fungus is the lowest form of plant life. It differs from other plants in lacking the green coloring matter characteristic of leaves. It obtains food from living or dead plants or animals. If from living, it is called a parasite; if from dead, it is called a saprophyte.

3. Is the blister-rust fungus a parasite?

The blister-rust fungus is a parasite because it obtains its food from living plants.

4. Where did the blister-rust disease come from?

The white-pine blister rust was brought into the United States on young white pine trees from Europe before there were any laws preventing or regulating the entry of plants into this country from foreign sources. The disease was first reported in the United States from Geneva, N. Y., in 1906, though it had probably entered this country as early as 1898.

5. How can you tell a white pine tree?

The needles or leaves are three to four inches long, arranged in clusters or bundles of five. The bark is smooth and grayish-green in color on young trees. The seeds are borne in cones 5 to 6 inches long. There are two-winged seeds at the base of each scale on the cone. The branches are arranged in whorls. The distance between each whorl of branches indicates one year's growth in height.

6. How does blister rust kill a white pine tree?

The blister-rust fungus enters a white pine tree through the needles, then grows slowly down through the bark of the branches into the trunk. The fungus robs the tree of its food and kills the bark. Thus, when it has completely encircled the trunk the flow of sap is shut off and the tree dies from girdling.

7. What is the appearance of blister rust on currants and gooseberries?

In the early summer, blister rust appears as orange-yellow spots or pustules on the underside of the leaves of wild and cultivated currants and gooseberries. These pustules produce the summer spores (spores may be considered tiny seeds) that spread the disease to other currant and gooseberry plants. During the late summer and early fall, these spots are gradually replaced by brown hairlike outgrowths, which produce the fall spores that spread the disease to white pine trees.

8. What is the appearance of blister rust on white pine?

On white pine trees, the fungus produces cankers, which are spindle-shaped swellings of diseased bark with a yellowish discoloration at their edges. During the first three years of their development, these cankers are recognized with difficulty except by one trained in their identification. In the spring of the third year, blisters filled with the orange-colored spring spores break through the diseased bark. When these blisters break open, millions of spores are scattered by the wind and spread the disease to the leaves of currant and gooseberry bushes.

9. How far may blister rust spread from infected pine trees to currant and gooseberry bushes?

Blister rust may spread for many miles from diseased white pines to currant and gooseberry bushes.

10. How far from pine trees is it necessary to destroy currant and gooseberry bushes to protect the trees from blister rust?

The spread of blister rust from currant and gooseberry bushes to white pines is relatively short. All currant and gooseberry bushes within 900 feet of white pine and all cultivated black currants within one mile of white pine must be destroyed to protect the trees.

11. How long is a pine tree infected with the disease before it is likely to be noticed?

A pine tree may be infected from two to three years before the disease becomes evident and even then it would not be noticed by the average pine owner. The owner would not be apt to notice the rust until it had killed some of the branches or the top of the tree.

12. How long does it take blister rust to kill a pine tree after it is first infected?

The time required to kill a pine tree depends on the size of the tree and the number and location of the infections on the tree. The smaller the tree the quicker it will die. Young trees up to 10 years old may be killed in 4 or 5 years after infection, while older trees require a correspondingly longer period of time.

13. Where can blister rust be found in Minnesota?

Blister rust is known to be present in Aitkin, Anoka, Benton, Carlton, Cass, Chisago, Crow Wing, Hennepin, Kanabec, Lake, Mille Lacs, Morrison, Sherburne, St. Louis and Wright counties.

14. Is the blister-rust disease spreading in this State?

Yes, blister rust is spreading slowly but steadily over the entire white pine area in Minnesota.

15. What has been done in Minnesota to control blister rust?

4,981 acres of white pine have been protected from blister rust in Minnesota. The important areas protected from blister rust include parts of Itasca, Jay Cooke and Inter-State parks. This control work has retarded the spread of blister rust in Minnesota in addition to protecting these areas from the disease.

16. What help does the State give pine owners who desire to protect their trees from blister rust?

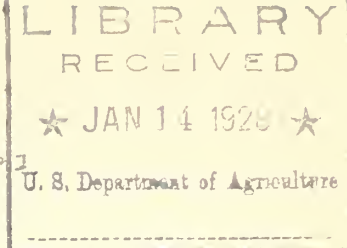
The State Forest Service will furnish an experienced foreman free of charge to supervise and to aid the owner and his crew of men in the eradication of wild currants and gooseberries in and near his pine stand.

17. Is Minnesota the only State that is carrying on white-pine blister-rust control work?

No, there are 17 States engaged in protecting their pine from this disease.



69 BXP  
LESSON PLAN *South Dakota*



Subject: Black Stem Rust and the Common Barberry

Teacher's Aim:

- (1) To become familiar with the common barberry and its relation to stem rust, and (2) to impart this information to the students.

Student's Aim:

- (1) To learn the essential facts concerning the life history and the importance of black stem rust. (2) To learn to recognize the common barberry and distinguish it from other shrubs, including the Japanese barberry; and (3) To disseminate this information in the community.

Correlations

The study of stem rust and the common barberry may be advantageously included in the study of any or all of the the following subjects: Botany, Biology, Agriculture, General Science, Nature Study, Language, Arithmetic, Geography, Spelling, and Drawing.

Sources of Information

United States Department of Agriculture Farmers' Bulletin 1058, and Department Circulars 269 and 356. South Dakota Extension Circular No. 240. Pamphlets prepared by the Conference for the Prevention of Grain Rust, 300 Lewis Building, Minneapolis, Minnesota.

Suggestions to the Teacher

The loss of grain in the principal grain-growing areas of the United States from black stem rust has increased greatly in the past fifty years somewhat in proportion to the number of common barberry bushes. These bushes were introduced and planted as shrubbery and hedges but their seeds have been scattered by birds and cattle to waste lands and wooded areas. Almost every farmer who has raised grain has suffered losses from black stem rust. Effective control of this disease is of vital interest to American agriculture. It is of especial importance in South Dakota where so much spring wheat is grown.

Small grains are attacked also by several other plant diseases which in some sections cause severe damage. The diseases most easily confused with stem rust are the leaf rusts of cereals, including crown rust of oats. Where the leaf rusts occur, pupils should be taught to distinguish between the leaf rusts and black stem rust, which is the only grain rust spread by the common barberry.

Read the bulletin carefully. Familiarize yourself with the answers to the questions. Allow the pupils to study the material, the bulletins, and the charts, before beginning any discussion on the subject. Divide the study questions into several rec-



itation periods as thought best. Emphasize the identification of the common barberry bush. Have the pupils bring to school samples of any bushes they may believe to be common barberry, and, if necessary, send the samples to the State Agricultural College, Brookings, South Dakota, for identification. Encourage the pupils to ask their parents about black stem rust and the damage it does. Explain carefully the relation of the common barberry to this rust. Point out clearly that the destruction of every common barberry is absolutely necessary for the successful control of black stem rust. Encourage the pupils to look for barberry bushes. When one is found, let all the neighbors see it and then report its location to the Barberry Eradication Office, State Agricultural College, Brookings, South Dakota.

### Definitions

Before beginning the study of black stem rust the following definitions should be mastered:

**PARASITE:** A living organism, either an animal or a plant, that lives on or in some other organism from which it derives its nourishment for the whole or a part of its existence. It produces no food of its own. A plant parasite, then, is a plant which steals its food from another living plant. Most such parasites are fungi, but not every fungus is a parasite as some are called saprophytes because they live on dead material.

**FUNGUS:** A fungus is a plant devoid of green coloring matter. Unlike green plants, it does not produce its own food materials, but obtains them from living or dead organic matter. It reproduces usually by means of spores. Examples of fungi: Toadstools, puffballs, bread molds, rusts, smuts, etc.

**SPORE:** A spore is a minute reproductive body or cell. It might very well be called the seed of the fungus.

**HOST or HOST PLANT:** Host plant is a term applied to the plant on or in which a parasite lives and from which it gets its food.

**LIFE CYCLE:** The life cycle of a plant or animal is the series of stages through which it passes before completing its full development.

**Examples:** An example of this can be found in the four stages of the life cycle of the butterfly. First, the egg, then the worm, next the pupa, and finally the butterfly. Black stem rust furnishes one of the best examples of the life cycle of a parasitic fungus.

### A. Economic Importance of Black Stem Rust

Question 1. What is black stem rust?

Answer - It is a disease of small grains.

Q. 2. Which grain crops does stem rust attack?

A. - It attacks wheat, oats, barley, and rye.

Ref. S. D. Circ. 240, p. 3.

Q. 3. Why is black stem rust such a serious disease?

A. - Because it damages so much grain every year. Severely rusted grain means crop failures and hard times for the farmers.

Ref. - S. D. Circ. 240, p. 3.

Q. 4. How much damage does stem rust do?

A. - From 1915 to 1926 inclusive, an average of 50,000,000 bushels of grain was destroyed each year by this disease in the north-central states. An average of more than 8,900,000 bushels of grain has been destroyed each year in South Dakota in that period.

Ref. - S. D. Circ. 240, p. 3; U. S. D. A. Circ. 356, p. 1.

Q. 5. How does stem rust damage the grain crops?

A. - It robs the grain plants of the food which is intended for the development of the kernels. As a result these kernels are under-nourished and shriveled from lack of food. Frequently, rust is so severe that kernels fail to develop. Compare a sample of rust-shriveled grain with a sample of plump grain which has not been damaged by rust.

Ref. - S. D. Circ. 240, p. 5.

Q. 6. Why is the market value of shriveled grain greatly reduced?

A. - Shriveled grain is not so heavy as the plump grain and its value for milling purposes is greatly reduced.

Go to your local elevator and inquire the market price of wheat weighing 58 pounds to the bushel and wheat weighing 48 pounds to the bushel. (Wheat that has been attacked by rust often weighs 10 or more pounds less per bushel than wheat which has been free from rust and other diseases.)

Q. 7. How can these losses to small grain crops be reduced?

A. - These losses can be reduced by using the proper control measures for black stem rust.

Q. 8. What are the proper control measures for stem rust?

A. - The eradication of all harmful barberries is one of the best control measures. Proper crop rotation, proper fertilizers, thorough preparation of the seed bed, early seeding and the use of early and best adapted varieties of grain will aid in the production of a sturdy plant which is less likely to be attacked by rust than weaker plants.

#### B. Relation of Common Barberry to Black Stem Rust.

Q. 1. Why will the eradication of the common barberry in South Dakota and adjacent states tend to stop destructive stem-rust epidemics?

A. - Without the common barberry the stem rust cannot get an early start every spring in South Dakota.

Ref. - S. D. Circ. 240, p. 6.

Q. 2. Does the common barberry cause rust?

A. - Stem rust is not caused by the barberry. This bush helps it to get an early start every spring. Rust is caused by a very small parasitic plant, which is similar to larger plants, except that it grows on, and takes food from the barberry and the grain crops instead of from the soil.

Ref. - U. S. D. A. Circ. No. 356, p. 1.

Q. 3. Name the four stages in the life cycle of stem rust.

A. - The four stages of black stem rust are:

- (1) THE YELLOW, CLUSTER-CUP, OR SPRING-SPORE STAGE. Develops only on the barberry bush. Produces yellow spores.
- (2) THE RED, OR SUMMER-SPORE, STAGE. Develops only on grains and grasses. Its reddish-brown spores spread to other grains and grasses and produce a second crop. In like manner, successive crops of summer spores develop about every ten days throughout the summer.
- (3) THE BLACK, OR WINTER-SPORE, STAGE. Develops only on grains and grasses. Follows the summer stage, producing its black spores in the red-spore pustules or in new pustules.
- (4) THE COLORLESS-SPORE STAGE. Produced in the early spring by germinating black spores. These colorless spores infect only the barberry producing the cluster-cup stage.

Ref. - U. S. D. A. Circ. No. 356, p. 2; S. D. Circ. 240, pp. 5,6,7 and 8.

Q. 4. Where does the rust live in the cold winter months?

A. - It lives on the grain stubble, grain straw, and many wild grasses.

Ref. - S. D. Circ. 240, p. 5.

Q. 5. Where does it get its food in the cold, winter months?

A. - The rust plant does not need food in the winter months because it is not growing. It rests during the winter and begins growth in the spring as the other plants do.

Q. 6. When does it begin to grow in the spring?

A. - It begins to grow in South Dakota during the latter part of April and the first part of May.

Q. 7. Where does the rust begin to grow in the spring?

A. - The black or resting spores which have lived through the winter germinate and produce tiny colorless spores which are blown to the barberry. These produce the rust on the leaves of the common barberry. (See sample of barberry, note the orange-colored spots. This is the rust plant as it grows, in the spring of the year.)

Q. 8. Can the rust begin its growth on the new grain crops every spring?

A. - In South Dakota stem rust cannot grow on the grain crops without first growing on the leaves of the common barberry.

Ref. - S. D. Circ. 240, p. 6.

Q. 9. How does the rust get from the barberry to the grain crops?

A. - It is blown by the wind from the leaves of the barberry to the grain fields.

Q. 10. How long does the rust live on the barberry leaf? On the grain crops?

A. - Rust spots grow on the barberry leaf for about three weeks to a month. Rust grows on the grain crops as long as the grain stays green, or until harvest time. It is during this time that the disease does so much damage.

Ref. - S. D. Circ. 240, p. 5.

Q. 11. How rapidly does stem rust spread from barberry bushes?

A. - Stem rust may spread very rapidly if weather conditions are favorable. Once off the barberry, the rust is blown from grain stem to grain stem and from grain field to grain field until the grain in a whole community, is rusted.

Q. 12. How far can the rust spread from a barberry bush?

A. - Many instances have been found where stem rust has spread for miles from a single barberry bush. A barberry does not necessarily have to be growing near to a grain field to spread rust to it.

Ref. - S. D. Circ. 240, pp. 9-10.

Q. 13. Does any other plant start rust?

A. - Stem rust has never been found to start on other plants.

Q. 14. Does rust grow on the Japanese barberry?

A. - No, this barberry is not harmful, and may be planted. It makes a beautiful hedge.

Ref. - S. D. Circ. 240, p. 2.

Q. 15. Does weather cause rust?

A. - Rust is not caused by weather, although it is aided by certain kinds of weather. Rust is caused by a tiny plant. All plants must have a seed, plenty of moisture, warmth, and a place to grow. The grain plants furnish a good place for the rust plant to grow if the weather is warm and there is plenty of rain. But the rust must have a starting place every spring. This place is furnished by the leaves of the common barberry bushes.

Ref. - S. D. Circ. 240, p. 8.

### C. Identification of Common Barberry.

Q. 1. Describe the appearance of a common barberry.

A. - The common barberry is an erect shrub of graceful habit. It ranges from a seedling bush of a few inches to a mature shrub of possibly twelve or more feet. The color of the leaves is a dull green. There also is a variety of the common barberry which has purple leaves.

Ref. - S. D. Circ. 240, p. 11; U. S. D. A. Circ. 356, p. 2.

Q. 2. Describe the outer bark, inner bark, leaves, thorns, flowers, and berries of the common barberry.

A. - The outer bark is grayish in color and is furrowed; the inner bark is a bright yellow. The leaves normally are produced in clusters. They always have bristle-toothed edges. The three-pointed thorns occur at the base of the leaf clusters. The flowers are yellow. The berries are green in the summer and red in the fall and winter. They are produced in drooping bunches like currants.

Ref. - S. D. Circ. 240, p. 11; U. S. D. A. Circ. 356, p. 2.



Q. 3. Compare the bark, berries, spines, and leaf edges of the Japanese and common barberries.

Characters	Common Barberry (Harmful)	Japanese Barberry (Harmless)
Bark	Gray	Reddish-brown
Berries	In bunches	Single or in twos
Spines	Usually in threes	Usually single
Leaf edges	Spiny	Smooth

Ref. - S. D. Circ. 240, p. 13.

#### D. Eradication of the Common Barberry.

Q. 1. What should be done with common barberry bushes?

A. - They should be dug or killed by putting salt on and around the crown of the bush.

Ref. - U. S. D. A. Circ. 356, p. 3.

Q. 2. Why is digging a barberry usually unsatisfactory?

A. - Because a small part of a root left in the ground will grow again. Salt will kill a bush completely.

Ref. - U. S. D. A. Circ. 356, p. 3.

Q. 3. Does South Dakota have a law condemning the common barberry?

A. - Yes, a law was passed in 1919. Similar laws are in force in each of the other States of the barberry eradication area.

Ref. - S. D. Circ. 240, p. 14.

Q. 4. Have many common barberries have been found and destroyed in South Dakota?

A. - Over 130,000 barberries already have been found and destroyed in South Dakota by Federal and State men, who are trying to find and destroy all of these harmful bushes in the State.

Q. 5. Are there any more harmful barberries growing in South Dakota?

A. - Undoubtedly there are many more of these harmful bushes in the State.

Q. 6. When all the barberries are found and destroyed will there be any more black stem rust?

A. - There may be some stem rust late in the summer, but in normal years there should be little damage from this disease.

Ref. - S. C. Circ. 240, p. 20.

Q. 7. Can school children help to find barberry bushes?

A. - Everyone can help by looking for barberry bushes. If a bush is found which is thought to be a barberry, a sample should be sent to the Barberry Eradication Office, Brookings, South Dakota. Someone from this office will see that it is destroyed.



## CORRELATIONS

### A. Language

Write a letter asking for bulletins on barberry eradication. Write a letter to some farmer telling him about the relation of the common barberry bush to black stem rust. Write essays and prepare talks on this subject. Write sentences containing the words suggested for a spelling lesson.

### B. Arithmetic

The following figures were obtained by actual counts made on a common barberry bush of medium size:

Total number of leaves .....	35,000
Percentage of leaves showing rust .....	30
Average number of rust clusters on each infected leaf.....	8
Average number of cups in each cluster .....	36
Average number of spores in one cup of a cluster .....	11,500

Q. 1. How many rusted leaves would there be on the average-sized bush?

A. - 28,000.

Q. 2. How many clusters of cluster-cups would there be on the average-sized bush?

A. - 224,000.

Q. 3. How many cluster-cups would there be on each leaf?

A. - 288

Q. 4. How many cluster-cups would there be on the entire bush?

A. - 8,064,000

Q. 5. How many spores would be produced on the entire bush?

A. - 92,736,000,000

Q. 6. If the wind distributed these spores so that one fell on each square inch of land surface, how many acres would the spores from this bush cover?

A. - 14,784

Q. 7. How many square miles is this?

A. - 23 square miles.

Q. 8. How many barberry bushes would it take to produce one spore, for every square inch of land surface in your county?

Q. 9. From 1915 to 1920 inclusive, an average loss of 50,000,000 bushels of wheat occurred each year from black stem rust in the North Central States. (This was before many barberries were eradicated in these States). From 1921 to 1926 inclusive the average loss in these same States amounted to only 16,000,000 bushels per year. (This was after millions of common barberries had been destroyed). At a \$1.10 per bushel, how much money did the farmers of this area save each year from 1921 to 1926?

A. - \$37,400,000

### C. Geography

Study the area in which the barberry eradication campaign is being carried on. Where is most of our spring wheat grown? Winter wheat? Give reasons for clearing this area of all common barberry bushes.

### D. Spelling

barberry	destructive	cooperation	chemical	germinating
eradication	disease	campaign	kerosene	common
destroys	epidemic	yield	average	European
stem rust	damage	weather	production	grain
spore	agriculture	reduced	escaped	sprouts
Japanese	cluster-cup	spine	prevention	resistant
grain	wheat.	pustule	distribution	bristle-toothed

### E. Drawing

Draw a picture of the common barberry bush. Color the leaves green, berries red, and the bark gray. Draw a picture of a leaf, twig, and group of spines of the common barberry and a picture of a rusted grain plant.

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This lesson plan is a combination of lesson plans prepared by members of the Office of Cereal Crops and Diseases, United States Department of Agriculture. It has been revised and adapted to the needs of South Dakota schools by R. O. Bulger (1) with the aid and suggestions of state officials and educators.

Furnished to the schools of South Dakota by the Office of Cereal Crops and Diseases, Bureau of Plant Industry, United States Department of Agriculture, in cooperation with the South Dakota State College, Brookings, South Dakota, the Conference for the Prevention of Grain Rust, 300 Lewis Building, Minneapolis, Minnesota, and the State Department of Public Instruction, Pierre, South Dakota.

(1) Agent, Office of Cereal Crops and Diseases, in charge of Barberry Eradication in South Dakota.

141  
9 BLP

# PROTECT OUR GRAIN CROPS from BLACK STEM RUST

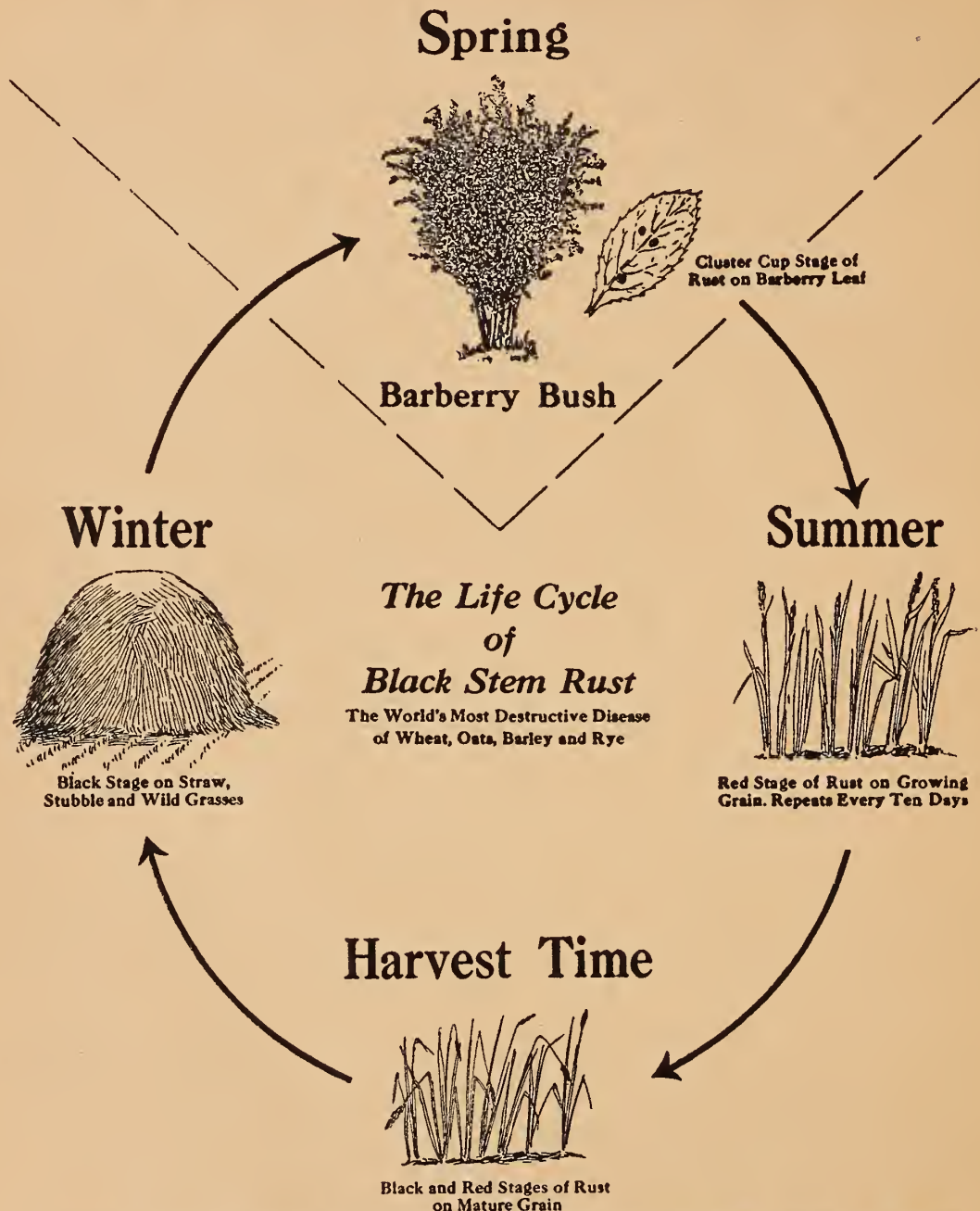


*Black Stem Rust, the Grain Grower's Worst Enemy, Must Be Controlled*

**A Guide for the Study of the Black Stem Rust of Small Grains  
and Its Relation to Common Barberry Bushes**



# Remove the Barberry and Break the Rust Cycle



All Common Barberries act as starting points for Black Stem Rust early each spring. By destroying the barberry the early spring source of black stem rust is eliminated. The Common Barberry provides a means to bridge the gap between the black stage on grain in the fall and the red stage of the rust on grains and grasses the following spring.

**BOOST BARBERRY ERADICATION—A PRACTICAL RUST  
CONTROL MEASURE**

THE ERADICATION OF THE COMMON BARBERRY

A lesson plan for teachers in Montana and Wyoming

Issued by the Office of Barberry Eradication  
Bureau of Plant Industry  
U. S. Department of Agriculture  
1930



## THE ERADICATION OF THE COMMON BARBERRY

### How to Use These Plans

- Design: To meet the needs of the recitation type of class, but could be adapted to the group or contract type, being given as problems.
- Arrangement: Arrangement of lesson topics is in accordance with the logical sequence of procedure and anticipates questions as they would arise in the mind of the student.
- Study Date: Lessons should be taken up in the spring at the time when bushes have leaves and conditions are right for field trips. Spring and summer may then be used by students in their follow-up work.
- Texts: A convenient booklet is published by the United States Department of Agriculture as Miscellaneous Publication No. 7, January, 1928, entitled "Bread or Barberries." Page references are given in the plans to this publication and also to U. S. Dept. Agr. Circ. 356, entitled "The Common Barberry and How to Kill It." It is suggested that enough of these be secured for the entire class.
- Materials: Pamphlets and posters may be obtained from your State Agricultural College. Help the Government distribute posters by tacking them up in conspicuous places in the community when the class is through with them.
- Assignments: Assignments should be made the day previous to the recitation. Assignments for advance work are important. Special care should be used to make everything clear, as this will increase the efficiency of the students' study time and increase the value of the recitation period. The points listed under "A. To stimulate interest" will stimulate in the child a desire to study the assignment.
- Aims: Both teacher and pupil should have in mind a definite aim while studying each lesson. The pupil's aim should be suggested while making assignment.
- Double-column Guide: This guide to recitation gives the teacher definite information opposite each question - at all times ready for reference. This proves of great value to teachers not familiar with the technical phases of the subject.
- Time: If the suggested time for each division of the lesson plan is carried out, it is believed better results will be obtained.

### Assignment for Lesson 1.

#### Black Stem Rust and the Resulting Economic Losses.

- A. To stimulate interest:  
What things do you eat containing products made from wheat or other small grains?  
What does black stem rust do to the grains?  
Why is grain important?
- B. Reading matter:  
Read pages 8, 9, 10, and 11 of U. S. Dept. Agr. Misc. Pub. 7,  
"Bread or Barberries."
- C. Pupil's Aim:  
To learn to what extent black stem rust is affecting small grains.

## LESSON 1

Assignment for Lesson 2: (2 minutes)

### Black Stem Rust and How it Lives

- A. To stimulate interest:  
What is black stem rust?  
Where does it live?  
What plants does it live upon?
- B. Reading matter:  
Answers will be found on pages 1 - 6 of U. S. Dept. Agr. Misc. Pub. 7, "Bread or Barberries."
- C. Pupil's Aim:  
Let us try to find out how and where this enemy is living.

Today's Lesson:

### Black Stem Rust and the Economic Losses it is Producing.

- A. Aims:
  - 1. Teacher: To bring to the student the fact that black stem rust is causing tremendous losses to our grain crops, and that if allowed to continue and increase, it will constitute a serious menace to our national supply of food.
  - 2. Pupil: To learn to what extent black stem rust is affecting the small grains.

Materials Needed:

- A. Samples - Black stem rust on stems from local fields. Shriveled kernels of wheat, barley, rye, and oats.  
Perfect kernels of wheat, barley, rye, and oats.  
Cereal products - Rolled oats, flour, rye bread, etc.
- B. Posters - "What Black Stem Rust Does to Our Small Grains."

Introduction: (1 minute)

Black stem rust is a disease that affects grain, wheat, oats, rye, and barley and cripples them much as infantile paralysis cripples children. The United States Government and the State Department of Agriculture, in cooperation with the Conference for the Prevention of Grain Rust, have issued a call to us, each of us, to come out and fight this grain disease. In order to be good soldiers we need to find out who, what, and where our enemy is. Today we shall discover to what extent grain rust is troubling our crops in the United States.

## Subject Matter

## Main (Pivotal) Questions

- | Subject Matter  | Main (Pivotal) Questions   |
|---|--|
| 1. Show specimens of different grain products.  | 1. What products do we make from perfect grains? (Allow student to name and then pick from your supply his specimen for exhibit to the class.)   |
| 2. Food - Man and Animal<br>Textile)<br>Paper ) Straw<br>Alcohol - Legitimate uses<br>Industry (Page 11 of "Bread or Barberries.")  | 2. Why are we dependent upon these grains?   |
| 3. Display samples, from local grain showing the effect upon the stem.  | 3. What does black stem rust look like?  |
| 4. Display grain kernels of as many different grains as you can obtain. Show perfect kernels and shriveled ones. If not able to obtain, show cut on page 10 of "Bread or Barberries." | 4. What does it do to the grain?<br>(a) Would these damaged kernels make good flour? Good cereals?   |
| 5. Colorado, Illinois, Indiana, Iowa, Michigan, Minnesota, Montana, Nebraska, North Dakota, South Dakota, Ohio, Wisconsin, Wyoming.   | 5. What States are most affected by grain rust?<br>(a) Where are these States located?<br>(b) Why are they most stricken?  |
| 6. Place before the student, the poster "What Black Stem Rust Does to Our Small Grains."  | 6. To what extent are these grain States affected?<br>(a) Review State by State.<br>(b) The average annual loss of wheat due to stem rust from 1916 to 1929, inclusive, is 30,000,000 bushels. |
| 7. U. S. Dept. Agr. Circ. No. 356, page 1.  | 7. The quantity of wheat lost in 1916 alone would make 11,000,000,000 loaves of bread.   |
| 8. Same poster as question 6.   | 8. What has this loss meant in dollars and cents?<br>Average annual loss from 1916 to 1929, more than \$50,000,000.  |
| 9. Feed all hungry people in the United States and foreign lands.   | 9. What could we do with this waste?   |
| 10. Become a national menace.   | 10. What will happen if we do not check the spread of black stem rust?   |
|   | 11. Having used these posters, we shall display them in the community where people may see them.   |

## LESSON 2

Assignment for Lesson 3: (2 minutes)

### History of Common Barberry

- A. To stimulate interest:  
How long has man known this plant?  
Why has it been cultivated although a pest?  
Of what use has it been?
- B. Reading matter:  
Find answers on pages 6, 7, 8, and 12 of "Erad or Barberries."
- C. Pupil's Aim:  
To look backward a few years and see if barberry toleration is worth what it costs.

Today's Lesson:

### Black Stem Rust and How it Lives

- A. Aims:
  - 1. Teacher: To give a biological insight into the habits and life cycle of rust and to show that eradication of the common barberry will relieve the serious existing condition.
  - 2. Pupil: To learn the habits and haunts of rust in order to combat this enemy in an intelligent way.

Materials Needed:

- A. Samples - Black stem rust on stems - local fields.
  - Plate 3 - from "Conference for the Prevention of Grain Rust, Minneapolis."
  - Plate 1 - The Life Cycle of the Black Stem Rust.
  - Envelope containing common barberry and "cluster cups."

Introduction: (1 minute)

Having found yesterday that black stem rust is damaging our crops a great deal, today we wish to learn how we may best combat this enemy. Let's take an example: Suppose that in our town, people were suffering from mosquitoes a great deal. Mosquitoes hatch only in stagnant water. On the outskirts of town we find a few stagnant pools. Which is easier, to rid ourselves of the pools or of the mosquitoes? Perhaps by knowing the complete life habits of the rust, finding where it lives, we may deal with it likewise.



Subject Matter	Main (Pivotal) Questions
<p>REVIEW - A short answer period not over 2 minutes in length, covering main points of yesterday's lesson.</p>	<p>Is plump grain important, and why? What is the worst grain enemy? What States are most affected?</p>
<p>ADVANCE:</p> <ol style="list-style-type: none"> <li>Have at hand the samples of rust on stems used in yesterday's work.               <ol style="list-style-type: none"> <li>It is a plant - fungus.</li> <li>It does not manufacture its own food but steals it from other living plants.</li> <li>People who are "spongers" on society.</li> </ol> </li> <li>One year.</li> <li> <ol style="list-style-type: none"> <li>Spring - Barberry only.</li> <li>Summer - Grain and grass.</li> <li>Fall - Grain and grass.</li> <li>Winter - Grain and grass.</li> </ol> </li> <li>Supply class with a plate which shows stages. Plate 3.</li> <li>Plate 1.</li> <li>Supply class with an envelope containing a sample of common barberry with "cluster cups."</li> <li>Wind carries thousands of spores from cluster cups.</li> <li>The cluster-cup spores from the barberry may spread rust by direct infection to a distance of many miles. As soon as the red or summer stage of rust appears on grains or grasses the wind can again carry the red spores for miles and scatter them on grain fields. The production of red-rust spores on the grain is repeated every 6 to 10 days in favorable weather. Rust has been traced for over 100 miles after starting from a single group of barberry bushes.</li> </ol>	<p>ADVANCE:</p> <ol style="list-style-type: none"> <li>Why is this disease called a rust?               <ol style="list-style-type: none"> <li>Is this disease a plant or an animal?</li> <li>Why is this plant called a parasite?</li> <li>Do we have any human parasites?</li> </ol> </li> <li>How much time does it take to make a complete trip around the life cycle of the rust?</li> <li>Name the four stages of its life.               <ol style="list-style-type: none"> <li>What parts of the year do they occupy</li> <li>Where <u>only</u> does the rust live in the spring?</li> </ol> </li> <li>Trace these stages on plates. Point out microscopic parts, and spores. Show that stage 5 is the same as stage 1.</li> <li>Show life cycle on Plate 1.</li> <li>How does rust appear on the common barberry? (Show envelopes)</li> <li>How does this stage get to the grain?</li> <li>How large an area may be affected by the rust from one group of barberries?</li> </ol>



Subject Matter	Main (Pivotal) Questions
<p>9. Produces pustules on stems. This chokes the plant and prevents food from reaching kernels that are developing, by allowing the sap of the plant to evaporate through the rust pustule openings. Shriveled kernels result.</p> <p>10. The locations of common barberry bushes should be reported to the State Leader in Charge of Barberry Eradication, Agricultural College, Bozeman, Mont., so that the bushes may be destroyed before further damage occurs.</p> <p>a. The common barberry.</p>	<p>9. How does the rust spoil the grain?</p> <p>10. Now what can we do? (a) Which home of the rust should be destroyed, the wheat or common barberry?</p>

### LESSON 3

Assignment for Lesson 4: (3 minutes)

#### Identification of the Common Barberry

A. To stimulate interest:

Have you ever seen the common barberry?

Is it a large or a small plant?

How can you tell one when you see it?

In what way may it be distinguished from other shrubs?

B. Reading matter:

1. Description on page 2, U. S. Dept. Agr. Circ. 356.

2. Study samples in envelopes and make drawings of the leaves and spines.

3. Study Plate 2 (Distinguish between Japanese and common barberry).

C. Pupil's Aim:

To learn to know the common barberry whenever seen.

Today's Lesson:

#### History of the Common Barberry

A. Aims:

1. Teacher: To give to the student the facts regarding the common barberry which will help to dispel the traditional belief that the common barberry is an ornamental friend.

2. Pupil: To look backward a few years and determine whether barberry toleration is worth what it costs.

Materials Needed:

A. "Bread or Barberries." U. S. Dept. Agr. Misc. Publ. 7.

Introduction: (1 minute)

From your reading you have gathered that the common barberry is not new to man. It has a checkered history. Is it worth to us all that it costs to tolerate it? By looking back over its records of the years, we should be able to sit as a jury, and determine the fate of the common barberry.

Subject Matter	Main (Pivotal) Questions
<p>REVIEW - A short answer period not over 2 minutes in length covering main points of yesterday's lesson (2).</p>	<p>Name four stages of rust life. How much time do they occupy? Where does the rust live in the spring? What does rust do to the grain?</p>
<p>ADVANCE:</p>	<p>ADVANCE:</p>
<p>1. 2,500 years, or more.</p>	<p>1. How long have men been acquainted with the common barberry?</p>
<p>2. Asia, India, Hindu writers.</p>	<p>2. In what country do we first hear of it? Who reported it?</p>
<p>3. Medicine from leaves and bark. Dyes and inks; yellow, green, red. Wood is tough, used for rake teeth. Leaves tender in spring, used as lemon juice is used; was acid; to make vinegar; make jam or jelly. Hedges - thorny.</p>	<p>3. Why was it important? How did men use it?</p>
<p>4. Seeds carried by man, birds, water, wind. Young plants transplanted by men.</p>	<p>4. How was common barberry spread throughout Europe?</p>
<p>5. Carried here as a friend by colonists.</p>	<p>5. How did it come to United States, where it was not native?</p>
<p>6. Lowell: "All down the loose walled lane in archin' bowers "The barb'ry droops its strings o' golden flowers."</p>	<p>6. What poet has mentioned the barberry?</p>
<p>7. Carried by pioneers. Used for hedges and shrubbery around houses.</p>	<p>7. How has common barberry spread to the Western States? For what used?</p>
<p>8. Noticed that if wind blew over hedge the grain on the windward side would rust.</p>	<p>8. How did men discover barberry - the traitor?</p>
<p>9. Destroyed barberry bushes, and no destructive rust appeared the following year.</p>	<p>9. What did they do, and what were the results?</p>
<p>10. It was not conclusive proof until scientists discovered the stages and habits as we learned them yesterday. (DeBary - 1865)</p>	<p>10. Was this proof that common barberry bushes spread rust?</p>
<p>11. Barberry eradication organized in U. S. in 1918 - U.S. Dept. of Agr., in cooperation with the 13 Western States affected. Surveys have been made. Schools have been asked to help.</p>	<p>11. What has been done?</p>

Subject Matter	Main (Pivotal) Questions
<p data-bbox="174 194 717 258">Every common barberry bush must be found and destroyed.</p> <p data-bbox="93 294 717 357">12. Denmark eradicated the common barberry and now has no rust.</p>	<p data-bbox="828 294 1444 357">12. Has any country been successful in barberry eradication?</p>

## LESSON 4

Assignment for Lesson 5: (2 minutes)

### Eradication of the Common Barberry

A. To stimulate interest:

There must be a vigorous campaign against any enemy if we expect victory.

Who is at the head of this campaign?

Who are the soldiers in this battle?

B. Reading matter:

1. Pages 13 - 14 of "Bread or Barberries."

2. Pages 3 - 4 of U. S. Dept. Agr. Circ. 356.

C. Pupil's Aim:

To determine who the leaders are in the struggle against the common barberry, and to find what part each individual will be privileged to play.

Today's Lesson:

### Identification of the Common Barberry

A. Aims:

1. Teacher: To bring before the student the characteristics of the common barberry and to distinguish it from the Japanese barberry.

2. Pupil: To learn to know the common barberry whenever seen.

Materials Needed:

A Envelope containing barberry sample showing "cluster cups."

Introduction: (1 minute)

We have shown how dangerous an enemy the common barberry is; that it should be destroyed. We do not wish to kill harmless plants. We therefore must study the plant, preserve any other harmless plants, and prevent the escape of the enemy.



## Subject Matter

REVIEW - A short answer period not over 2 minutes in length covering main points of yesterday's lesson (3).

## ADVANCE:

If possible it will be best to make this a field trip to some actual bushes and will be outlined as such. If feasible, have the county agriculturist direct this trip. If a field trip is impossible, bring plants of common barberry and Japanese barberry to the room, or use plates provided by the U. S. Department of Agriculture.

1. Determined by local conditions.
2. 5 to 7 feet tall - sometimes 12 feet, very erect.
3. Grayish (outside); yellow (inside).
4. Spines usually in groups of three to five, at base of leaf. But may have only one in some cases.
5. Have bristle-toothed edges.
6. Yellow
7. Clusters of berries - like currants, oblong shaped, bright red.
8. Same leaves, but yellow bark and roots.
9. Yes. On underside of leaves.
10. No. Locate bush of Japanese barberry.
11. Japanese rarely over 4 or 5 feet tall. Not erect - spreading.
  - (a) Japanese - reddish.
  - (b) Single usually, although more may occur.
  - (c) Smooth edges.
  - (d) Single, or two or three. Not in clusters.

## Main (Pivotal) Questions

How long have men known barberry?  
 Of what importance was it?  
 What are the harmful effects of barberry?  
 Is the tolerance of common barberry worth what it costs?

## ADVANCE:

Designate a student to demonstrate each characteristic that you wish to point out. This should be passed around the class as much as possible, and not to one student only.

1. What kind of a place does the common barberry choose in which to live?
2. What is its habit of growth?
3. Color of bark? Outside? Inside?
4. Where are the spines produced - how many?
5. What are the peculiarities of the leaves?
6. What is the color of the flowers?
7. Does the bush have fruit? Describe.
8. Describe small sprouts and seedlings. Do you find any?
9. Can you find any cluster cups of the rust?
10. Should the Japanese barberry bush be destroyed?
11. What is the difference in habit between the two barberries?
  - (a) Difference in bark?
  - (b) Difference in spines?
  - (c) Difference in leaves?
  - (d) Difference in berries?

Subject Matter	Main (Pivotal) Questions
(e) No. (f) No. Save it.	(e) Can you find any rust cluster- cups on the leaves of this plant? (f) Is it harmful?

## LESSON 5

Assignment for Lesson 6: (2 minutes.)

### Organizing for Action

- A. To stimulate interest:
  - Does an army have organization?
  - Must we not have organization?
  - Should not the public be informed of what we are trying to do?
- B. Each student is to write a 200-word article on the barberry menace and what each citizen's responsibility is. The two best articles will be sent to the local newspaper on successive weeks (or days).

Today's Lesson:

### Eradication of the Common Barberry

- A. Aims:
  - 1. Teacher: To link the pupil's interest and knowledge with the constituted campaign against the barberry and to acquaint him with his privilege and duty.
  - 2. Pupil: To determine who are the leaders against the common barberry, and to find out what part each individual will be privileged to play.

Introduction: (1 minute)

Victory never is won by passive resistance or cowardice. This nation does not make war on other nations, unless in defense, for we desire peace at all times. But we have been attacked by the common barberry and we must fight. The whole nation's agricultural outlook depends upon the successful eradication of the common barberry. Scientific study has shown that it should be killed, and our perusal of its history has convinced us that we must tolerate it no longer. We must discover our duty in this campaign.

Subject Matter	Main (Pivotal) Questions
<p>REVIEW - A short answer period not over 2 minutes in length covering main points of yesterday's lesson (4).</p>	<p>Distinguish between the two barberries as to habit of growth. Distinguish between color of bark, leaves, spines, fruit. What should be our attitude toward the common barberry?</p>
<p>ADVANCE:</p>	<p>ADVANCE:</p>
<p>1. U. S. Department of Agriculture. (Point out that no better leader could be secured.)</p>	<p>1. Who is at the head of the campaign against the common barberry?</p>
<p>2. (a) 13 of the North-Central States where wheat is most grown. (b) The State colleges of agriculture. (c) Farmers, newspaper men, nursery men, teachers, and students. (d) State Agriculture Departments. (e) The Conference for the Prevention of Grain Rust, Minneapolis, Minn.</p>	<p>2. Who are cooperating with the Government?</p>
<p>3. (a) Learn to know the common barberry. (b) Report any bush you find to the County Agriculturist or State College and send a sample twig of the bush and its location to either office. The proper authorities will verify your identification and destroy the bush. (c) Tell the story of the harmful common barberry to anyone who does not understand it. (d) Report any severe outbreak of rust which occurs in your locality to either of the above offices.</p>	<p>3. How can we help?</p>
<p>4. (a) By digging. (Use care to get all roots.) (b) Salt treatment. Bush with 12-inch base - 20 lbs. Bush with 6-inch base - 10 lbs. Put salt at base of all shoots. Keep farm animals away from salt, for they may die if they eat too much. (c) Kerosene. Bush with 12-inch base - 1 gal. Bush with 6-inch base - 2 qts. Drench ground around all shoots.</p>	<p>4. How may the common barberry bush be destroyed? (a) Name one method. (b) Name another.  (c) Name another method.</p>
<p>5. Barberries near valuable shrubs or trees should not be killed with chemicals but should be dug.</p>	<p>5. What precautions are necessary in chemical treatment?</p>



LESSON 6  
Organization for Action

1. Take up papers prepared by class.
2. Introduction: (Not more than 5 minutes) Reserve plenty of time for organizing.

Now comes the test of our loyalty to community, State, and nation. Our study of the common barberry has shown that its eradication will benefit the world. The test of a good citizen is the way he applies himself to the tasks he knows he should do for the sake of his community. You may be good citizens by forming groups for barberry eradication. An army must have organization - so must we. And today if each of you is willing to go at this task whole heartedly, we will organize. You may form two groups, and may compete with each other for the spring and summer. We need a captain for each group; a name; a color; a secretary; poster men; and a display committee. This will give every one something to do.

As an added incentive and reward for the service which we shall render our State and nation, by reporting common barberry bushes, the Conference for the Prevention of Grain Rust will present a beautiful bronze medal to any boy or girl who reports a property on which such bushes are growing. A national organization known as the National Rust Busters Club has been formed of all the boys and girls who promise to "Look for common barberry bushes, report them and tell every one how they spread black stem rust." Finding a property having common barberry gives anyone a life membership in the Club, as well as a beautiful medal. See how many medals each group can win.

Do not expect to find common barberries very plentiful in this neighborhood, for in the whole State of Montana only 39,943 bushes, sprouting bushes, and seedlings have been found during the years 1918 to 1929, inclusive. But here where wheat is our most important crop it is much more important to find one barberry bush than to locate several hundred in some of our Eastern States where small grains are only minor crops. The Government wants to find and kill every common barberry bush. Let us become active "Rust Busters."

Organization

Have class elect two captains.  
Captains then choose their groups from the class.

Group Meetings

Each group selects:

Duties:

Group name.

Group color.

Newspaper correspondent - - - - -	To give report every two weeks regarding activity of group.
Secretary - - - - -	To keep accurate list of all activities.
Poster men - - - - -	Direct the making of posters, securing of posters from rust agencies, and postin them.



Display committee - - - - - To prepare full display of barberry, its results, and how and why it should be destroyed. This display should be shown in the town or county fair. It might even be taken to the State Fair.

#### Explanation

1. Each group is to hunt common barberry bushes, spring, and summer, whenever it can.
2. Bushes are to be reported to the State Leader of Barberry Eradication at the Agricultural College, Bozeman, Mont., and then reported to the group secretary, who will keep a record of each person and his activities. All barberry bushes will be treated or dug by Government barberry field agents.
3. Color is for tying on barberry bushes to show others that this bush already has been treated or reported.
4. Each group captain should have a copy of this sheet.



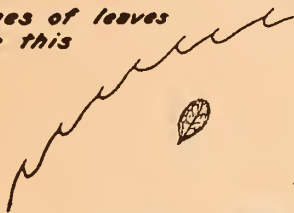
# Common Barberry Spreads Black Stem Rust

## Know Common Barberry

Look For It!

*When you find  
a spiny bush  
with-*

*Edges of leaves  
like this*



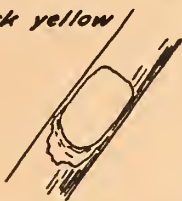
*Spines like these*



*Berries like these*



*Inner bark yellow*



*It is a  
Common Barberry  
and should be  
reported at once*

*Spread of  
Barberries by  
birds*

*Birds eat the  
berries*



*Carry them to their  
roosting places -*



*Where they cough  
up the seeds*



*From which seedling  
bushes grow*



*They in time  
bear fruit which  
is again carried  
farther on*

### Look For and Report All Common Barberry Bushes

To the State Leader of Barberry Eradication, Bozeman, Montana

# Common Barberry Bushes

*spread*

## *Black Stem Rust*

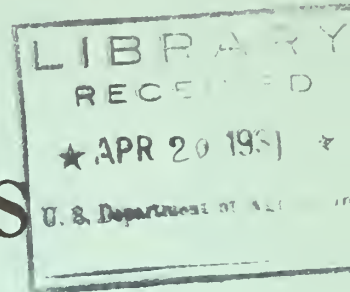
to

WHEAT, OATS,  
BARLEY, RYE,  
and Many Wild  
Grasses

THIS Study Guide is prepared and printed by the Bureau of Plant Industry, U. S. Department of Agriculture, Washington, D. C. The cover is furnished by the Conference for the Prevention of Grain Rust, 300 Lewis Building, Minneapolis, Minnesota.



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# PROTECT OUR GRAIN CROPS *from* ***BLACK STEM RUST***

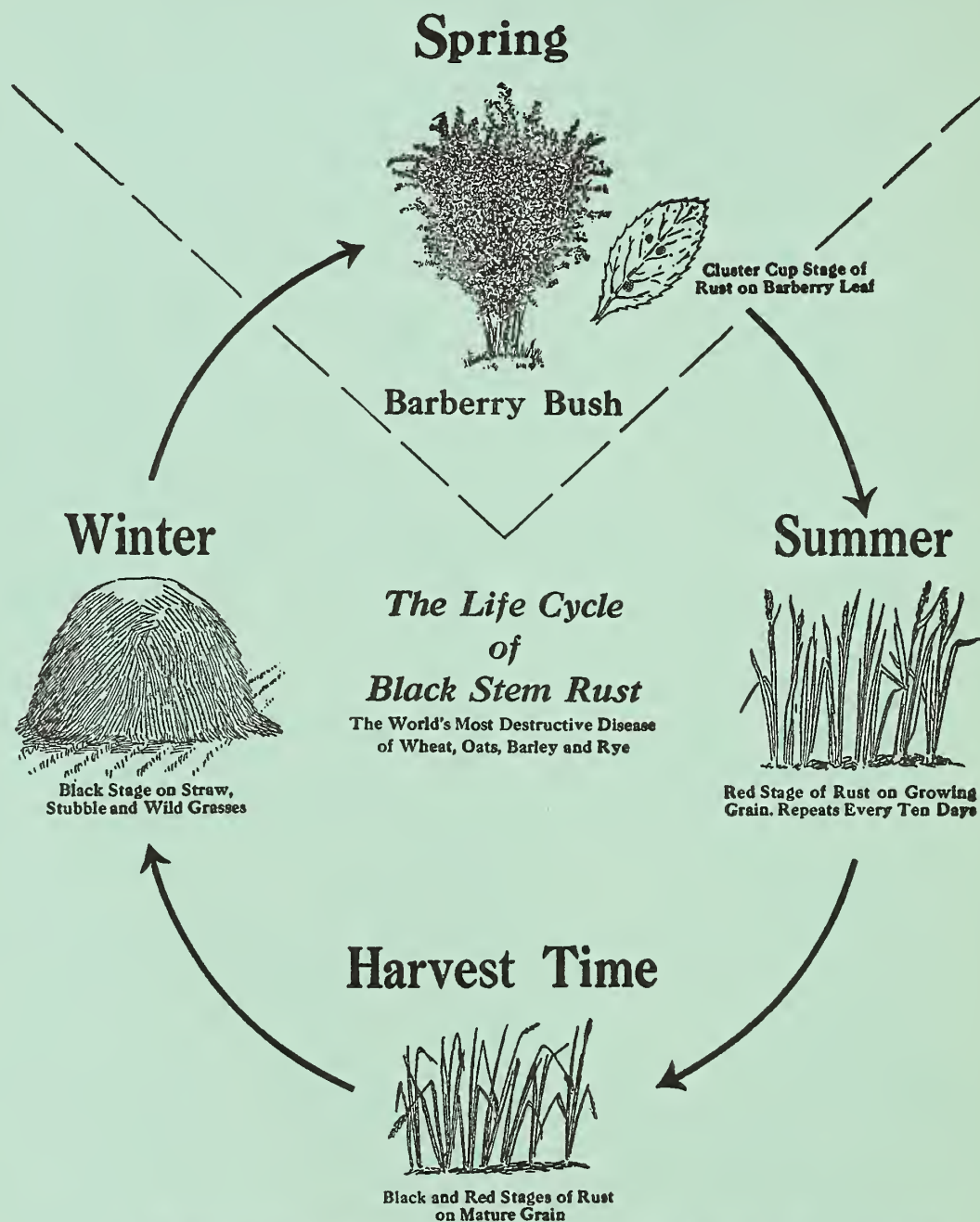


***Black Stem Rust, the Grain Grower's Worst Enemy, Must Be Controlled***

**A Guide for the Study of Black Stem Rust of Small Grains  
and Its Relation to Common Barberry Bushes**



# Remove the Barberry and Break the Rust Cycle



All Common Barberries act as starting points for Black Stem Rust early each spring. By destroying the barberry the early spring source of black stem rust is eliminated. The Common Barberry provides a means to bridge the gap between the black stage of the rust on grain in the fall and the red stage on grains and grasses the following spring.

**BOOST BARBERRY ERADICATION—A PRACTICAL RUST CONTROL MEASURE**

THE ERADICATION OF THE COMMON BARBERRY  
A lesson plan for teachers in Ohio.

Issued by the Office of Barberry Eradication  
Bureau of Plant Industry  
U. S. Department of Agriculture  
1931

"The destruction of all common barberry bushes is a  
huge task. Good citizenship means cooperation."

# THE ERADICATION OF THE COMMON BARBERRY

## How to Use These Plans

Design: To meet the needs of the recitation type of class, but could be adapted to the group or contract type, being given as problems.

Arrangement: Arrangement of lesson topics is in accordance with the logical sequence of procedure and anticipates questions as they would arise in the mind of the student.

Study Date: Lessons should be taken up in the spring at the time when bushes have leaves and conditions are right for field trips. Spring and summer may then be used by students in their follow-up work.

Texts: A convenient booklet is published by the United States Department of Agriculture as Miscellaneous Publication No. 7, January, 1928, entitled "Bread or Barberries." Page references are given in the plans to this publication and also to U. S. Dept. Agr. Circ. 356, entitled "The Common Barberry and How to Kill It." It is suggested that enough of these be secured for the entire class.

Materials: Pamphlets and posters may be obtained from your State Agricultural College. Help the Government distribute posters by tacking them up in conspicuous places in the community when the class is through with them.

Assignments: Assignments should be made the day previous to the recitation. Assignments for advance work are important. Special care should be used to make everything clear, as this will increase the efficiency of the students' study time and increase the value of the recitation period. The points listed under "A. To stimulate interest" will stimulate in the child a desire to study the assignment.

Aims: Both teacher and pupil should have in mind a definite aim while studying each lesson. The pupil's aim should be suggested while making assignment.

Double-column Guide: This guide to recitation gives the teacher definite information opposite each question - at all times ready reference for those teachers not familiar with the technical phases of the subject.

Time: If the suggested time for each division of the lesson plan is carried out, it is believed better results will be obtained.

### Assignment for Lesson 1.

#### Black Stem Rust and the Resulting Economic Losses.

##### A. To stimulate interest.

What things do you eat containing products made from wheat or other small grains?

What does black stem rust do to the grains?

Why is grain important?

##### B. Reading matter:

Read pages 8, 9, 10, and 11 of the U. S. Dept. Agr. Misc. Pub 7, "Bread or Barberries."

- C. Pupil's Aim:  
To learn to what extent black stem rust is affecting small grains.

## LESSON 1

Assignment for Lesson 2: (2 minutes)

### Black Stem Rust and How it Lives

- A. To stimulate interest:  
What is black stem rust?  
Where does it live?  
What plants does it live upon?
- B. Reading matter:  
Answers will be found on pages 1 - 6 of U. S. Dept. Agr. Misc. Pub. 7, "Bread or Barberries."
- C. Pupil's Aim:  
Let us try to find out how and where this enemy is living.

Today's Lesson:

### Black Stem Rust and the Economic Losses it is Producing

- A. Aims:
1. Teacher: To bring to the student the fact that black stem rust is causing tremendous losses to our grain crops, and that if allowed to continue and increase it will constitute a serious menace to our national supply of food.
  2. Pupil: To learn to what extent black stem rust is affecting the small grains.

Materials Needed:

- A. Samples - Black stem rust on stems from local fields. Shrivled kernels of wheat, barley, rye, and oats. Perfect kernels of wheat, barley, rye, and oats. Cereal products - Rolled oats, flour, rye bread, etc.
- B. Posters - "What Black Stem Rust Does to Our Small Grains."

Introduction: (1 minute)

Black stem rust is a disease that affects grain, wheat, oats, rye, and barley and cripples them much as infantile paralysis cripples children. The United States Government and the State



Department of Agriculture, in cooperation with the Conference for the Prevention of Grain Rust, have issued a call to us, each of us, to come out and fight this grain disease. In order to be good soldiers we need to find out who, what, and where our enemy is. Today we shall discover to what extent grain rust is troubling our crops in the United States.

**LESSON 1      Teacher's Guide to Recitation (17 minutes)**

Answers and References	Main (Pivotal) Questions
1. Show specimens of different grain products.	1. What products do we make from perfect grains? (Allow student to name and then pick from your supply his specimen for exhibit to the class.)
2. Food - Man and Animal Textile) Paper ) Straw Alcohol - Legitimate uses Industry (Page 11 of "Bread or Barberries.")	2. Why are we dependant upon these grains?
3. Display samples, from local grain showing the effect upon the stem.	3. What does black stem rust look like?
4. Display grain kernels of as many different grains as you can obtain. Show perfect kernels and shriveled ones. If not able to obtain, show cut on page 10 of "Bread or Barberries."	4. What does it do to the grain? (a) Would these damaged kernels make good flour? Good cereals?
5. Colorado, Illinois, Indiana, Iowa, Michigan, Minnesota, Montana, Nebraska, North Dakota, South Dakota, Ohio, Wisconsin, Wyoming.	5. What States are most affected by grain rust? (a) Where are these States located? (b) Why are they most stricken?
6. Place before the student, the poster "What Black Stem Rust Does to Our Small Grains."	6. To what extent are these grain States affected? (a) Review State by State. (b) The average annual loss of wheat due to stem rust from 1916 to 1930, inclusive, is 28,000,000 bushels.



Answers and References	Main (Pivotal) Questions
7. U. S. Dept. Agr. Circ. No. 356, page 1.	7. The quantity of wheat lost in 1916 alone would make 11,000,000,000 loaves of bread.
8. Same poster as question 6.	8. What has this loss meant in dollars and cents? Average annual loss from 1916 to 1930, more than \$47,000,000.
9. Feed all hungry people in the United States and foreign lands.	9. What could we do with this waste?
10. Become a national menace.	10. What will happen if we do not check the spread of black stem rust?
	11. Having used these posters, we shall display them in the community where people may see them.

## LESSON 2

Assignment for Lesson 3: (2 minutes)

History of Common Barberry

- A. To stimulate interest:  
How long has man known this plant?  
Why has it been cultivated although a pest?  
Of what use has it been?
- B. Reading matter:  
Find answers on pages 6, 7, 8, and 12 of "Bread or Barberries."
- C. Pupil's Aim:  
To look backward a few years and see if barberry toleration is worth what it costs?

Black Stem Rust and How it Lives

A. Aims:

1. Teacher: To give a biological insight into the habits and life cycle of rust and to show that eradication of the common barberry will relieve the serious existing condition.
2. Pupil: To learn the habits and haunts of rust in order to combat this enemy in an intelligent way.

Materials Needed:

- A. Samples - Black stem rust on stems - local fields.  
Plate 3 - from "Conference for the Prevention of Grain Rust, Minneapolis."  
Plate 1 - The Life Cycle of the Black Stem Rust.  
Envelope containing common barberry and "Cluster cups."

Introduction: (1 minute)

Having found yesterday that black stem rust is damaging our crops a great deal, today we wish to learn how we may best combat this enemy. Let's take an example: Suppose that in our town, people were suffering from mosquitoes a great deal. Mosquitoes hatch only in stagnant water. On the outskirts of town we find a few stagnant pools. Which is easier, to rid ourselves of the pools or of the mosquitoes? Perhaps by knowing the complete life habits of the rust, finding where it lives, we may deal with it likewise.

LESSON 2 Teacher's Guide to Recitation (17 minutes)

Answers and References	Main (Pivotal) Questions
REVIEW - A short answer period not over 2 minutes in length. covering main points of yesterday's lesson	Is plump grain important, and why? What is the worst grain enemy? What States are most affected?
ADVANCE: 1. Have at hand the samples of rust on stems, used in yesterday's work. (a) It is a plant - fungus. (b) It does not manufacture its own food but steals it from living plants.	ADVANCE: 1. Why is this disease called a rust? (a) Is this disease a plant or an animal? (b) Why is this plant called a parasite?

Answers and References	Main (Pivotal) Questions
(c) People who are "spongers" on society.	(c) Do we have any human parasites?
2. One year.	2. How much time does it take to make a complete trip around the life cycle of the rust?
3. (a) Spring - Barberry only. (b) Summer - Grain and grass. (c) Fall - Grain and grass. (d) Winter - Grain and grass.	3. Name the four stages of its life. (a) What parts of the year do they occupy? (b) Where <u>only</u> does the rust live in the spring?
4. Supply class with a plate which shows stages. Plate 3	4. Trace these stages on plates. Point out microscopic parts, and spores. Show that stage 5 is the same as stage 1.
5. Plate 1	5. Show life cycle on Plate 1.
6. Supply class with an envelope containing a sample of common barberry with "cluster cups."	6. How does rust appear on the common barberry? (Show envelopes.)
7. Wind carries thousands of spores from cluster cups.	7. How does this stage get to the grains?
8. The cluster-cup spores from the barberry may spread rust by direct infection to a distance of many miles. As soon as the red or summer stage of rust appears on grains or grasses the wind can again carry the red spores for miles and scatter them on grain fields. The production of red-rust spores on the grain is repeated every 6 to 10 days in favorable weather. Rust has been traced for more than 100 miles after starting from a single group of barberry bushes.	8. How large an area may be affected by the rust from one group of barberries?

Answers and References	Main (Pivotal) Questions
<p>9. Produces pustules on stems. This chokes the plant and prevents food from reaching kernels that are developing, by allowing the sap of the plant to evaporate through the rust pustule openings. Shriveled kernels result.</p> <p>10. The locations of common barberry bushes should be reported to the Office of Barberry Eradication, 8 East Broad St., Columbus, Ohio, so that the bushes may be destroyed before further damage occurs. (a) The common barberry.</p>	<p>9. How does the rust spoil the grain?</p> <p>10. Now what can we do? (a) Which home of the rust should be destroyed, the grain or common barberry?</p>

### LESSON 3

Assignment for Lesson 4: (3 minutes)

#### Identification of the Common Barberry

- A. To stimulate interest:  
 Have you ever seen the common barberry?  
 Is it a large or a small plant?  
 How can you tell one when you see it?  
 In what way may it be distinguished from other shrubs?
- B. Reading matter:
1. Description on page 2, U. S. Dept. Agr. Circ. 356.
  2. Study samples in envelopes and make drawings of the leaves and spines.
  3. Study Plate 2 (distinguish between Japanese and common barberry)
- C. Pupil's Aim:  
 To learn to know the common barberry whenever seen.



Today's Lesson:

History of the Common Barberry

A. Aims:

1. Teacher: To give to the student the facts regarding the common barberry which will help to dispel the traditional belief that the common barberry is an ornamental friend.
2. Pupil: To look backward a few years and determine whether barberry toleration is worth what it costs.

Materials Needed:

A "Bread or Barberries." U. S. Dept. Agr. Misc. Pub. 7.

Introduction: (1 minute)

From your reading you have gathered that the common barberry is not new to man. It has a checkered history. Is it worth to us all that it costs to tolerate it? By looking back over its records of the years, we should be able to sit as a jury, and determine the fate of the common barberry.

LESSON 3                      Teacher's Guide to Recitation (16 minutes)

Answers and References	Main (Pivotal) Questions
REVIEW - A short answer period not over 2 minutes in length covering main points of yesterday's lesson (2).	Name four stages of rust life. How much time do they occupy? Where does the rust live in the spring? What does rust do to the grains?
ADVANCE: 1. 2,500 years, or more.	ADVANCE: 1. How long have men been acquainted with the common barberry?
2. Asia, India, Hindu writers.	2. In what country do we first hear of it? Who reported it?
3. Medicine from leaves and bark. Dyes and inks; yellow, green, red. Wood is tough, used for rake teeth. Leaves tender in spring, used as lemon juice is used; was acid; to make vinegar; make jam or jelly. Hedges - thorny.	3. Why was it important? How did men use it?



Answers and References	Main (Pivotal) Questions
4. Seeds carried by man, birds, water, wind. Young plants transplanted by men.	4. How was common barberry spread throughout Europe?
5. Carried here as a friend by colonists.	5. How did it come to United States, where it was not native?
6. Lowell: "All down the loose walled lane in archin' bowers "The barb'ry droops its strings 'o golden flowers."	6. What poet has mentioned the barberry?
7. Carried by pioneers. Used for hedges and shrubbery around houses.	7. How has common barberry spread to the Western States. For what used?
8. Noticed that if wind blew over hedge the grain on the windward side would rust.	8. How did men discover barberry - the traitor?
9. Destroyed barberry bushes, and no destructive rust appeared the following year.	9. What did they do, and what were the results?
10. It was not conclusive proof until scientists discovered the stages and habits as we learned them yesterday. (DeBary - 1865.)	10. Was this proof that common barberry bushes spread rust?
11. Barberry eradication organized in U. S. in 1918 - U. S. Dept. of Agr., in cooperation with the 13 Western States affected. Surveys have been made. Schools have been asked to help. Every common barberry must be found and destroyed.	11. What has been done?
12. Denmark eradicated the common barberry and now has no rust.	12. 'as any country been successful in barberry eradication?

## LESSON 4

Assignment for Lesson 5: (2 minutes)

### Eradication of the Common Barberry

- A. To stimulate interest:  
There must be a vigorous campaign against any enemy if we expect victory.  
Who is at the head of this campaign?  
Who are the soldiers in this battle?
- B. Reading matter:
  - 1. Pages 13 - 14 of "Bread or Barberries."
  - 2. Pages 3 - 4 of U. S. Dept. Agr. Circ. 356.
- C. Pupil's Aim:  
To determine who the leaders are in the struggle against the common barberry, and to find what part each individual will be privileged to play.

Today's Lesson:

### Identification of the Common Barberry

- A. Aims:
  - 1. Teacher: To bring before the student the characteristics of the common barberry and to distinguish it from the Japanese barberry.
  - 2. Pupil: To learn to know the common barberry whenever seen.

Materials Needed:

Envelope containing barberry sample showing "cluster cups."

Introduction: (1 minute)

We have shown how dangerous an enemy the common barberry is: that it should be destroyed. We do not wish to kill harmless plants. We therefore must study the plant, preserve any other harmless plants, and prevent the escape of the enemy.

## LESSON 4      Teacher's Guide to Recitation (17 minutes)

<u>Answers and References</u>	<u>Main (Pivotal) Questions</u>
REVIEW - A short answer period not	How long have men known barberry?

Answers and References	Main (Pivotal) Questions
<p>over 2 minutes in length covering main points of yesterday's lesson (3).</p>	<p>Of what importance was it?            What are the harmful effects of barberry?            Is the tolerance of common barberry worth what it costs?</p>
<p>ADVANCE:            If possible it will be best to make this a field trip to some actual bushes and will be outlined as such. If feasible, have the county agriculturist direct this trip. If a field trip is impossible, bring plants of common barberry and Japanese barberry to the room, or use plates provided by the U. S. Department of Agriculture.</p>	<p>ADVANCE:            Designate a student to demonstrate each characteristic that you wish to point out. This should be passed around the class as much as possible, and not to one student only.</p>
<ol style="list-style-type: none"> <li>1. Determined by local conditions.</li> <li>2. 5 to 7 feet tall - sometimes 12 feet, very erect.</li> <li>3. Grayish (outside); yellow (inside).</li> <li>4. Spines usually in groups of three to five, at base of leaf. But may have only one in some cases.</li> <li>5. Have bristle-toothed edges.</li> <li>6. Yellow.</li> <li>7. Clusters of berries - like currants, oblong shaped, bright red.</li> </ol>	<ol style="list-style-type: none"> <li>1. What kind of a place does the common barberry choose in which to live?</li> <li>2. What is its habit of growth?</li> <li>3. Color of bark? Outside? Inside?</li> <li>4. Where are the spines produced - how many?</li> <li>5. What are the peculiarities of the leaves?</li> <li>6. What is the color of the flowers?</li> <li>7. Does the bush have fruit? Describe.</li> </ol>

LESSON 4 Cont'd Teacher's Guide to Recitation (17 minutes)

Answers and References	Main (Pivotal) Questions
8. Same leaves, but yellow bark and roots.	8. Describe small sprouts and seedlings. Do you find any?
9. Yes. On underside of leaves.	9. Can you find any cluster cups of the rust?
10. No. Locate bush of Japanese barberry.	10. Should the Japanese barberry bush be destroyed?
11. Japanese rarely over 4 or 5 feet tall. Not erect - spreading. (a) Japanese - reddish. (b) Single usually, although more may occur (c) Smooth edges (d) Single, or two or three. Not in clusters.  (e) No.  (f) No. Save it.	11. What is the difference in habit between the two barberries? (a) Difference in bark? (b) Difference in spines?  (c) Difference in leaves? (d) Difference in berries?  (e) Can you find any rust cluster-cups on the leaves of this plant?  (f) Is it harmful?

LESSON 5

Assignment for Lesson 6: (2 minutes)

Organizing for Action

- A. To stimulate interest:  
Does an army have organization?  
Must we not have organization?  
Should not the public be informed of what we are trying to do?
- B. Each student is to write a 200-word article on the barberry menace and what each citizen's responsibility is. The two best articles will be sent to the local newspaper on successive weeks (or days).



Today's Lesson:

Eradication of the Common Barberry

A. Aims:

1. Teacher: To link the pupil's interest and knowledge with the constituted campaign against the barberry and to acquaint him with his privilege and duty.
2. Pupil: To determine who are the leaders against the common barberry, and to find out what part each individual will be privileged to play.

Introduction: (1 minute)

Victory never is won by passive resistance or cowardice. This nation does not make war on other nations, unless in defense, for we desire peace at all times. But we have been attacked by the common barberry and we must fight. The whole nation's agricultural outlook depends upon the successful eradication of the common barberry. Scientific study has shown that it should be killed, and our perusal of its history has convinced us that we must tolerate it no longer. We must discover our duty in this campaign.

LESSON 5      Teacher's Guide to Recitation (17 minutes)

Answers and References	Main (Pivotal) Questions
REVIEW - A short answer period not over 2 minutes in length covering main points of yesterday's lesson (4).	Distinguish between the two barberries as to habit of growth. Distinguish between color of bark, leaves, spines, fruit. What should be our attitude toward the common barberry?
ADVANCE:	ADVANCE:
1. U. S. Department of Agriculture. (Point out that no better leader could be secured.)	1. Who is at the head of the campaign against the common barberry?
2. (a) 13 of the North-Central States where wheat is most grown. (b) The State Colleges of Agriculture.	2. Who are cooperating with the Government?



Answers and References	Main (Pivotal) Questions
<p>(c) Farmers, newspaper men, nursery men, teachers, and students.</p> <p>(d) State Agricultural Departments.</p> <p>(e) The Conference for the Prevention of Grain Rust, Minneapolis, Minnesota.</p>	
<p>3. (a) Learn to know the common barberry.</p> <p>(b) Report any bush you find to the County Agriculturist or State College of Agriculture and send a sample twig of the bush and its location to either office. The proper authorities will verify your identification and destroy the bush.</p> <p>(c) Tell the story of the harmful common barberry to anyone who does not understand it.</p> <p>(d) Report any severe outbreak of rust which occurs in your locality to either of the above offices.</p>	<p>3. How we can help?</p>
<p>4. (a) By digging. (Use care get all roots.)</p> <p>(b) Salt treatment.</p> <p>Bush with 12-inch base - 20 lbs. Bush with 6-inch base - 10 lbs. Put salt at base of all shoots. Keep farm animals away from salt, for they may die if they eat too much.</p> <p>(c) Kerosene.</p> <p>Bush with 12-inch base - 1 gal. Bush with 6-inch base - 2 qts. Drench ground around all shoots.</p>	<p>4. How may the common barberry bush be destroyed?</p> <p>(a) Name one method.</p> <p>(b) Name another</p> <p>(c) Name another method.</p>
<p>5. Barberries near valuable shrubs or trees should not be killed with chemicals but should be dug.</p>	<p>5. What precautions are necessary in chemical treatment?</p>

## LESSON 6

### Organization for Action

1. Take up papers prepared by class.
2. Introduction: (Not more than 5 minutes) Reserve plenty of time for organizing.

Now comes the test of our loyalty to community, State, and Nation. Our study of the common barberry has shown that its eradication will benefit the world. The test of a good citizen is the way he applies himself to the tasks he knows he should do for the sake of his community. You may be good citizens by forming groups for barberry eradication. An army must have organization - so must we. And today if each of you is willing to go at this task whole heartedly, we will organize. You may form two groups, and may compete with each other for the spring and summer. We need a captain for each group; a name; a color; a secretary; poster men; and a display committee. This will give every one something to do.

The number of harmful barberry bushes to be found in your community may be few or many depending upon how many were planted years ago. From 1918 to 1930 a total of more than 18 million bushes and seedlings has been destroyed in our thirteen Northern grain-growing States. Some neighborhoods have very few bushes, others a great many. Carefully inspecting all dooryards, orchards, woodlots, windbreaks, stream banks, and ravines is necessary in order to locate all bushes. Only one bush left growing in a county would be sufficient to cause a serious rust loss as well as to serve as a center from which barberry bushes would spread. Let us become active "Rust Busters."

### Organization

Have class elect two captains.  
Captains then choose their groups from the class.

## Group Meetings

Each group selects:

Duties:

Group name.

Group color.

Newspaper correspondent- - - - - - - -To give report every two weeks regarding activity of group.

Secretary - - - - - To keep accurate list of all activities.

Poster men - - - - - Direct the making of posters, securing of posters from rust agencies, and posting them.

Display committee - - - - - To prepare full display of bar-  
berry, its results, and how and  
why it should be destroyed. This  
display should be shown in the town  
or county fair. It might even be  
taken to the State Fair

### Explanation

1. Each group is to hunt common barberry bushes, spring, and summer, whenever it can.
2. Bushes are to be reported to the Office of Barberry Eradication, East Broad St., Columbus, Ohio, and then reported to the group secretary, who will keep a record of each person and his activities. All barberry bushes will be treated or dug by Government barberry field agents.
3. Color is for tying on barberry bushes to show others that this bush already has been treated or reported.
3. Each group captain should have a copy of this sheet.





# BLACK STEM RUST SPREADS FROM COMMON BARBERRIES



to Wheat, Oats, Barley, Rye and other Grasses.

Black Stem Rust as it appears on the leaves of the Common Barberry



Enlarged single leaf



Plump healthy grain

Shriveled rusted grain



## DANGEROUS NEIGHBORS



Common Barberry Bushes growing near grain fields



Report Common Barberry bushes you may find to your State Leader of Barberry Eradication.



Common Barberry is harmful, destroy



Japanese Barberry is harmless, do not destroy







FLOWERS  
(yellow)

BERRIES  
(bright red)

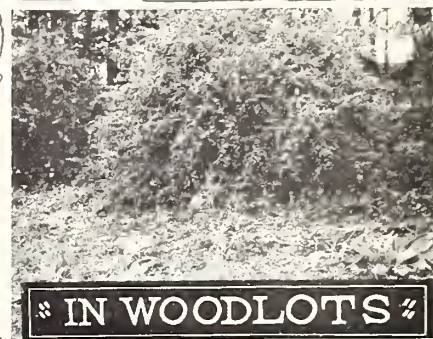
## Where Barberry Bushes Grow



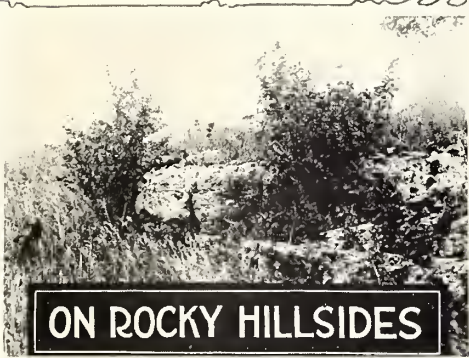
IN DOORYARDS



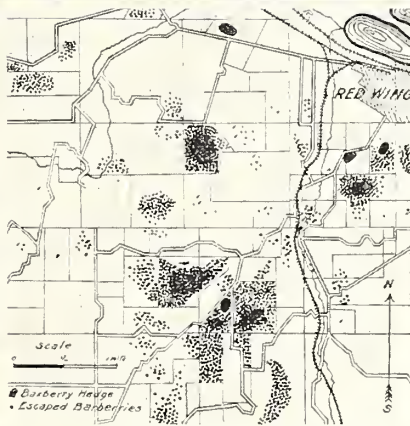
BIRDS CARRY BARBERRY SEEDS SEVERAL MILES, DROPPING THEM AMONG ROCKS AND IN OUT-OF-THE-WAY PLACES



IN WOODLOTS

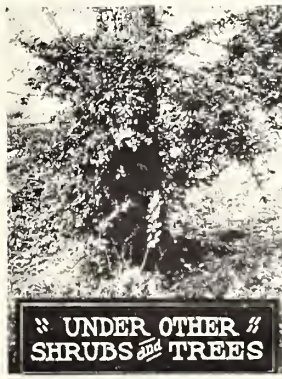


ON ROCKY HILLSIDES



AS HEDGE FENCES

Barberries spread by birds



UNDER OTHER  
SHRUBS *and* TREES







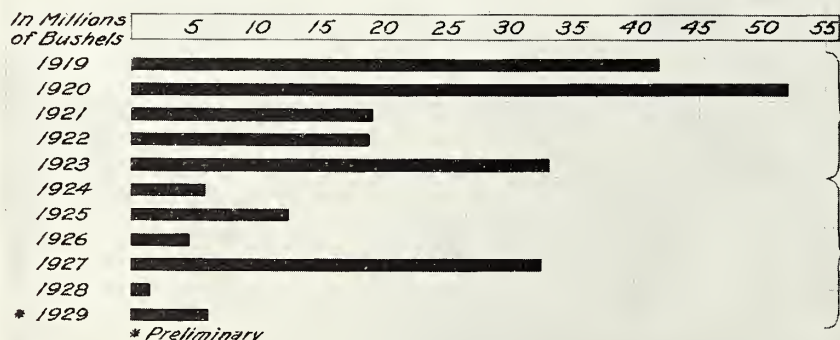
Salting a bush



Sprouts from a dug bush

## Common Salt Kills Barberry Bushes and Prevents Sprouting

### Wheat Losses in Barberry Eradication Area, 1919-1929



The average annual loss for the first five year period, 1919 to 1923, was approximately 33,000,000 bushels.

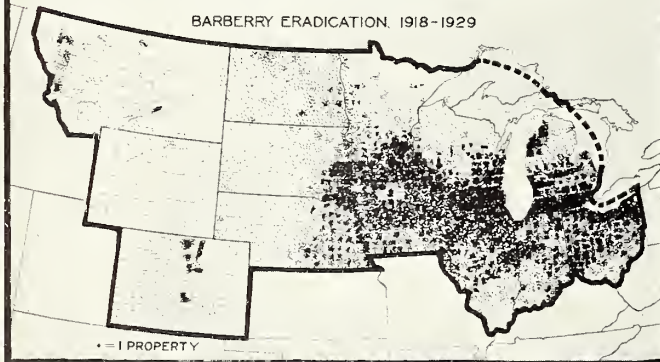
The average annual loss for the next six year period, 1924 to 1929, was approximately 10,500,000 bushels.

The losses to small grain crops caused by black stem rust have been reduced since the beginning of the barberry eradication campaign in 1918. The breeding of rust-resistant varieties, the use of early maturing varieties, and the sowing of crops early, have aided barberry eradication in this reduction.

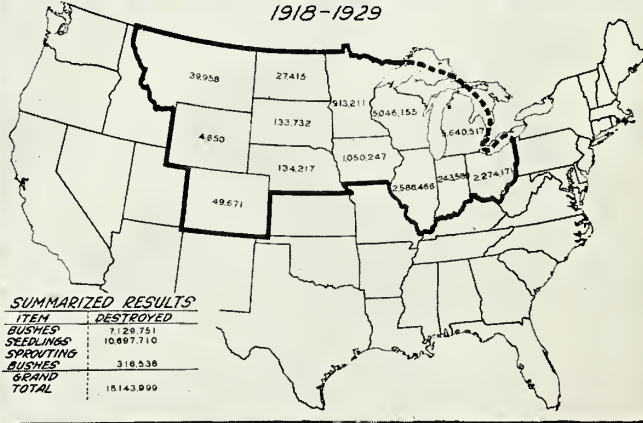
## "BARBERRY ERADICATION PAYS"

### RURAL PROPERTIES ON WHICH BARBERRY BUSHES WERE FOUND-ALL SURVEYS

BARBERRY ERADICATION, 1918-1929



### NUMBERS OF BARBERRY BUSHES AND SEEDLINGS DESTROYED 1918-1929

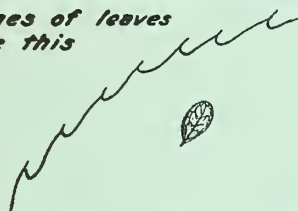


Prepared by the Rust Prevention Association, 300 Lewis Building, Minneapolis, Minn., in co-operation with Bureau of Plant Industry, U. S. Department of Agriculture, Washington, D. C.

# Common Barberry Spreads Black Stem Rust

*When you find  
a spiny bush  
with-*

*Edges of leaves  
like this*



*Spines like these*



*Berries like these*



*Inner bark yellow*



*It is a  
Common Barberry  
and should be  
reported at once*

**Know  
Common  
Barberry**

***Look For It!***

*Spread of  
Barberries by  
birds*

*Birds eat the  
berries*



*Carry them to their  
roosting places*



*Where they cough  
up the seeds*



*From which seedling  
bushes grow*



*They in time  
bear fruit which  
is again carried  
farther on*

**Look For and Report All Common Barberry Bushes**

***To the Barberry Eradication Office, in care of your State Department  
of Agriculture or your State Agricultural College***

# Common Barberry Bushes

*spread*

## *Black Stem Rust*

*to*

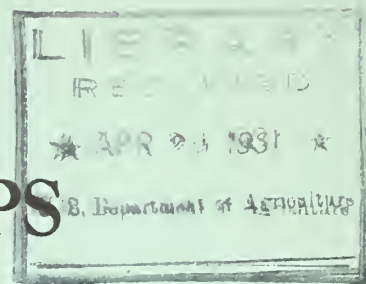
WHEAT, OATS,  
BARLEY, RYE,  
*and* Many Wild  
Grasses

**T**HIS Study Guide is prepared and printed by the Bureau of Plant Industry, U. S. Department of Agriculture, Washington, D. C. The cover is furnished by the Conference for the Prevention of Grain Rust, 300 Lewis Building, Minneapolis, Minnesota.



1.9  
p. 9/10/p

# PROTECT OUR GRAIN CROPS



*from*

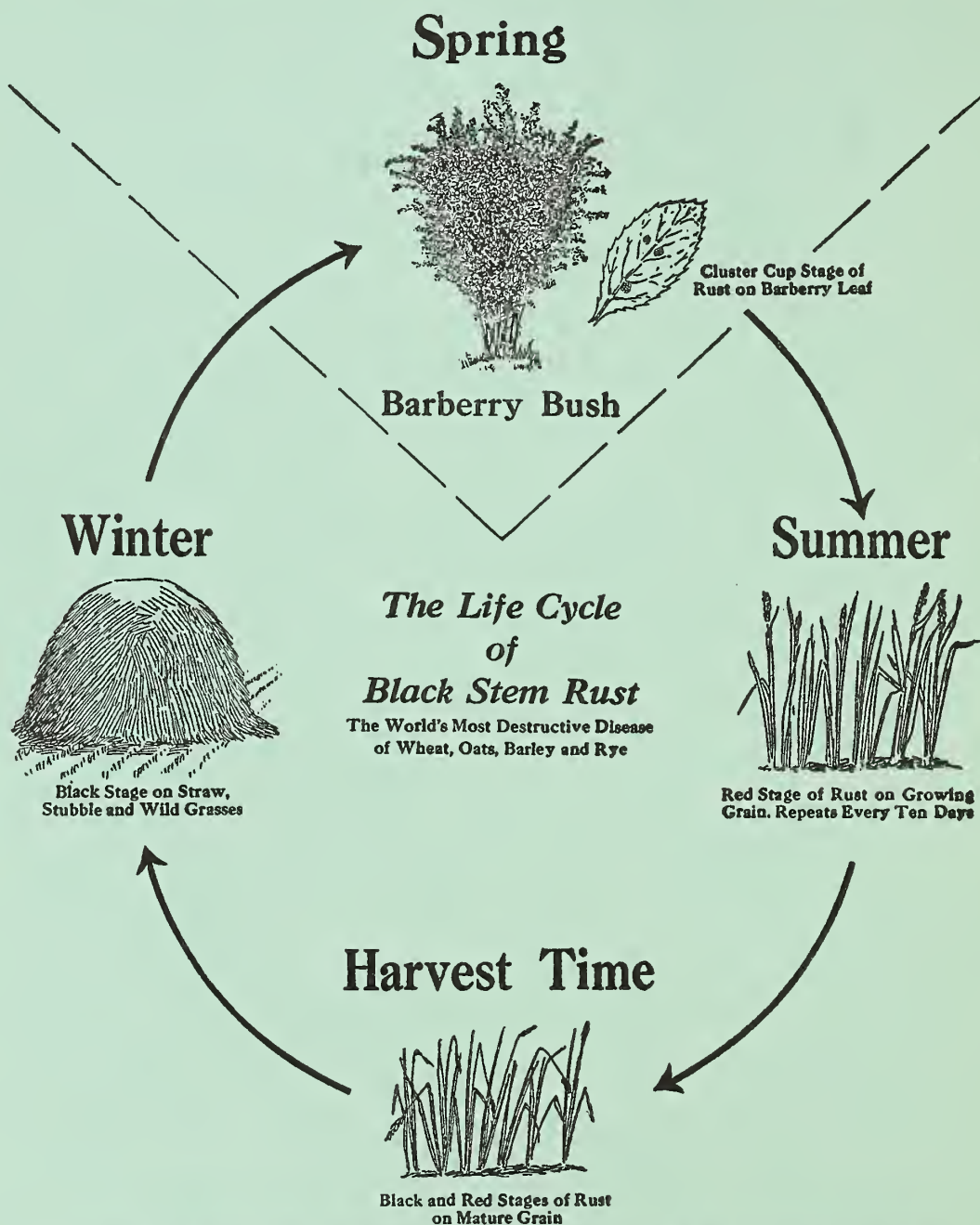
## ***BLACK STEM RUST***



***Black Stem Rust, the Grain Grower's Worst Enemy, Must Be Controlled***

**A Guide for the Study of Black Stem Rust of Small Grains  
and Its Relation to Common Barberry Bushes**

# Remove the Barberry and Break the Rust Cycle



All Common Barberries act as starting points for Black Stem Rust early each spring. By destroying the barberry the early spring source of black stem rust is eliminated. The Common Barberry provides a means to bridge the gap between the black stage of the rust on grain in the fall and the red stage on grains and grasses the following spring.

**BOOST BARBERRY ERADICATION—A PRACTICAL RUST CONTROL MEASURE**

A GUIDE FOR THE STUDY OF BLACK STEM RUST OF SMALL GRAINS  
AND ITS RELATION TO COMMON BARBERRY BUSHES

Especially Prepared for Use in Wisconsin Schools





To the Teachers of Wisconsin:

This lesson plan and accompanying study material are offered to the rural and State graded schools in Wisconsin to be used as part of the teaching program in nature study or agriculture.

The lesson plan is designed especially for the presentation of the subject matter to pupils of the fifth, sixth, seventh, and eighth grades and it has been divided into three separate units. Each teaching unit is organized in the manner of a supervised study in which pupils are asked simple questions on short reading assignments and upon their observations of the material provided.

The directions and questions may be written upon the blackboard to guide the pupils as they prepare the lesson.

The single-word answer test and the completion test have been included, since they offer an interesting method for determining the results of this study.

The United States Department of Agriculture, the State Department of Agriculture and Markets, the State University, and others are combining their efforts to control the destructive black stem rust disease of small grains. This lesson plan and study material are so arranged as to stimulate the observational powers of the pupils, promote their interest in nature study, and give them information relative to the nature and control of black stem rust.

Additional materials are available at this office and will be gladly sent upon request. Information regarding the use of the lesson plan or the location of common barberry bushes should be sent to

Office of Barberry Eradication,  
State Capitol Annex,  
Madison, Wisconsin.

This guide for the study of black stem rust of small grains and its relation to common barberry bushes has the approval and endorsement of the following:

Mr. John Callahan, Superintendent of Public Instruction for the State of Wisconsin, Madison, Wisconsin.

Mr. F. C. Meier, Principal Pathologist in Charge, Office of Barberry Eradication, Bureau of Plant Industry, United States Department of Agriculture, Washington, D. C.

A GUIDE FOR THE STUDY OF BLACK STEM RUST OF SMALL GRAINS  
AND ITS RELATION TO COMMON BARBERRY BUSHES

PART I

HOW TO KNOW BLACK STEM RUST; ITS CAUSE AND IMPORTANCE

THE APPEARANCE AND CAUSE OF BLACK STEM RUST

Examine the specimens of rust upon grain stems.  
Study also the illustration opposite Page 8 in the Wis. State  
Dept. of Agr. Bul. No. 84.

Determine:

1. What is the shape of the rust pustules on the grain stems?

(They usually are narrow and oblong in shape.)

2. What may be the color of the rust pustules?

(Black stem rust is black only during the fall and winter and is reddish-brown during the summer.)

Read Pages 3 and 4 of the Wis. State Dept. of Agr. Bul. No. 84,  
where the answers to the following questions will be found:

3. What is black stem rust?

(It is the most destructive disease of small-grain crops in Wisconsin.)

4. What grains does it attack?

(Oats, wheat, barley, and rye.)

5. What is the cause of black stem rust?

(A tiny fungous plant which grows upon the grain plant and steals food from that plant.)

6. What do the rust pustules contain?

(Thousands of small spores or "seeds" of the rust plant.)

7. How do the rust spores spread?

(The wind carries the spores of the rust fungus to grains and grasses.)

Look for black rust pustules on stubble and grass stems in your locality.

Compare these stems with the specimens at school.

#### THE IMPORTANCE OF BLACK STEM RUST

8. What is the average annual loss caused by black stem rust?

(In the 13 north-central States over 50,000,000 bushels of grain. In Wisconsin over 1,000,000 bushels of grain.)

Look carefully at samples of grain from rusted wheat plants and from healthy wheat plants.

9. What has happened to the kernels from the rusted wheat plants?

(The kernels are shriveled and light in weight as compared with the plump kernels from healthy plants.)

10. Which kernels do you think contain the most food?

(The kernels from the healthy plants contain the most food.)

11. What has happened to the food which should have gone into the shriveled kernels?

(The food was stolen and used by the rust fungus.)

12. Which kind of grain sells for more money?

(Plump grain brings much the better price.)

13. How would the yield of a field of shriveled grain compare with the yield of a field of plump grain?

(The yield of shriveled grain is very low and the crop often is not worth harvesting. Plump grain usually yields well.)



## PART II

HOW BLACK STEM RUST IS SPREAD BY THE COMMON BARBERRY

## THE LIFE STORY OF THE BLACK STEM-RUST FUNGUS

Read the "Bread or Barberries" pamphlet, Pages 1 to 7 answering the following questions as you read.

Observe the pictures carefully.

1. On what plant besides the grains and grasses does the black stem rust fungus grow?

(It grows on the common barberry bush.)

2. What is the spore of a fungus, and what can it do?

(A spore is a very small "seed" of a fungus which may develop a new fungous plant.)

3. Where is the source of the rust spores which grow on the barberry bush?

(From the spores which have lived through the winter in the black pustules on the grasses and stubble.)

Look at the barberry leaves sent to your school.

Use a magnifying glass if you have one.

4. Why are the rust spots on the barberry called cluster-cups?

(Because each spot is composed of many small cups.)

From the pamphlet again, find out:

5. What is to be found in these cups?

(The cups contain thousands of small, yellow spores.)

6. What happens to these yellow spores, and where do they grow?

(The yellow spores are scattered into the wind like dust and are carried away to grains and grasses.)

7. What is to be found on the grain plant about ten days after these yellow spores are carried there by the wind?

(Red, oblong stem-rust pustules filled with red spores are present.)

8. What happens when these red spores are carried to another grain plant?

(A new red pustule of stem rust will be formed, and the disease will spread rapidly.)

9. When does the black stage of stem rust appear?

(The black stage of stem rust appears when the grain begins to ripen.)

10. What happens to the black spores?

(They live through the winter and in the spring again produce the colorless spores which are carried by the wind to the common barberry bush.)

11. What would happen to the stem rust if the barberry bush were removed?

(The colorless spores would die, because they can grow on no other plant, and therefore the stem rust would fail to get an early start in the spring.)

### PART III

#### THE CAMPAIGN TO FIND AND DESTROY THE COMMON BARBERRY BUSH

#### HOW TO KNOW THE COMMON BARBERRY AND TO DISTINGUISH THE HARMLESS JAPANESE BARBERRY

Look again at your specimen of barberry and read about this barberry in the State Dept. of Agr. Bul. No. 84, Pages 12 and 13.

1. What kind of a plant is the common barberry bush?

(The common barberry bush is an erect shrub which may grow over 12 feet high.)

2. What is the appearance of the edges of the leaves?

(The edges of the leaf are bristle-toothed.)

3. How do the berries grow?

(The berries grow in bunches like currants.)

4. How many points have the spines or thorns?  
(Usually they have three points)
5. What color are the flowers?  
(The flowers are bright yellow.)
6. What color is the bark beneath the surface?  
(The bark beneath the surface is yellow.)
7. How did the common barberry bushes get into Wisconsin?  
(The early settlers brought them from Europe or New England.)
8. What is a Japanese barberry bush?  
(A small shrub, seldom over 4 feet high, which does not spread stem rust.)
9. How does it differ from the common barberry bush?
  - (a. It usually is much smaller.)
  - (b. The leaves have smooth edges.)
  - (c. The berries grow singly or in pairs.)

#### THE WORK OF DESTROYING THE COMMON BARBERRY BUSH

Pages 13, 14, and 15 of State Dept. of Agr. Bul. No. 84 tell of the campaign to destroy the common barberry.

10. How long ago were laws made prohibiting the growing of common barberries?  
(Laws were made over 100 years ago in the American Colonies and in Europe.)
11. When was the campaign started to destroy barberry bushes in Wisconsin?  
(The barberry eradication campaign was started in Wisconsin in 1918.)
12. Where are barberry bushes commonly found?  
(Planted bushes are usually found in farm and city door-yards, parks, and gardens. Wild (escaped) bushes may grow in the woods, in pastures, and along fences, streams, etc.)

13. How many barberry bushes and seedlings have been found in Wisconsin, according to Table 3?

(3,628,737 bushes and 1,459,316 seedlings.)

Read the summary on the inside cover of State Bul. No. 84, which tells what one may do to help this campaign.

14. What would you do if you found a common barberry bush?

(Report its location to the State Entomologist at Madison, Wisconsin, who will see that it is destroyed.)

Compare twigs of bushes which you suspect are common barberries with the samples of barberry bushes sent to your school and with the pictures in the bulletins.

### TESTS

The following tests cover quite fully the material studied in the lessons. The subject matter tested in the first is duplicated to a considerable extent in the second, and a choice between the two should be made.

Directions: Write a one-word answer to the following questions:

1. How many kinds of grain are attacked by black stem rust?  
(Four.)
2. In how many different stages may black stem rust be found?  
(Four.)
3. Which stage of black stem rust grows on the barberry bush?  
(Cluster-cup.)
4. Which stage of black stem rust appears first on grain?  
(Red.)
5. Which stage of black stem rust lives through the winter in Wisconsin?  
(Black.)
6. Which kind of barberry bush spreads black stem rust?  
(Common.)
7. What kind of a plant is common barberry,--tree, shrub, or herb?  
(Shrub.)
8. What is the appearance of the edges of its leaves?  
(Bristle-toothed.)
9. What is the color of the bark beneath the surface?  
(Yellow.)
10. What other kind of barberry bush is commonly grown?  
(Japanese.)
11. Does it spread stem rust?  
(No.)
12. What is the appearance of the edges of its leaves?  
(Smooth.)



## COMPLETION TEST

Directions: The missing words of this short discussion are to be supplied by the pupils in blank forms given to them or written upon the blackboard. These words are assembled in an irregular order at the end of the test.

Stem rust is a \_\_\_\_\_ of grain crops caused by a fungus. The crop plants attacked are \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_ and \_\_\_\_\_. This disease spreads to grain from the \_\_\_\_\_ during the \_\_\_\_\_ and the early part of \_\_\_\_\_. Black stem rust on the barberry appears as \_\_\_\_\_ spots on the leaves which are known as \_\_\_\_\_. These cups are filled with thousands of very small \_\_\_\_\_ which are scattered by the \_\_\_\_\_ to \_\_\_\_\_ and \_\_\_\_\_. Each spore if carried to the grain plant grows into the plant and produces the \_\_\_\_\_ rust upon the stems. When the weather is \_\_\_\_\_ and \_\_\_\_\_ the rust develops \_\_\_\_\_ and may spread from plant to plant until a crop is ruined. Over one \_\_\_\_\_ bushels of grain are destroyed by black stem rust in Wisconsin each year. The rust turns \_\_\_\_\_ in the fall and lives through the winter on the \_\_\_\_\_ and \_\_\_\_\_ of the grain.

\_\_\_\_\_ is the \_\_\_\_\_ plant on which this black stem rust can start to grow the next season. The \_\_\_\_\_ spores die during the \_\_\_\_\_. Therefore the eradication of the \_\_\_\_\_ will do away with the spring starting place of the rust and prevent its development.

Select from this list the word to be filled in above:

common	straw	summer
rapidly	spores	yellow
red	black	barley
rye	disease	cluster-cups
winter	wheat	hot
grasses	spring	stubble
oats	grains	only
wind	barberry	damp
	million	

## DEFINITIONS

(The words defined below will be met frequently in reading the literature dealing with black stem rust.)

PARASITE: A parasite is a plant or animal that lives on or in some other plant or animal from which it derives its nourishment. It produces no food of its own. Thus, black stem rust is a parasite stealing its food from the grain plant.

FUNGUS: A fungus is a plant lacking green coloring matter. Unlike green plants, it does not produce its own food materials but obtains them from living or dead organic matter. It reproduces usually by means of spores. Examples of fungi are toadstools, puff balls, bread mold, rusts, smuts, etc.

SPORE: A spore is a minute reproductive body of a fungus. Spores can be compared to the seeds of higher plants.

PUSTULE: A pustule is a single spot of rust containing many spores of the rust fungus.

HOST OR HOST PLANT: Host plant is a term applied to the plant on or in which a parasite lives and from which it gets its food.

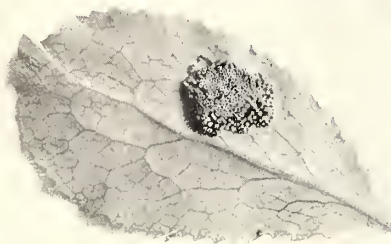
LIFE CYCLE: The life cycle of a plant or animal is the series of stages through which it passes before completing its full development. Examples: An example of this can be found in the four stages of the life cycle of the butterfly. First, the egg, then the worm, next the pupa, and finally the butterfly. Black stem rust furnishes one of the best examples of the life cycle of a parasitic fungus.

# BLACK STEM RUST SPREADS FROM COMMON BARBERRIES



to Wheat, Oats, Barley, Rye and other Grasses.

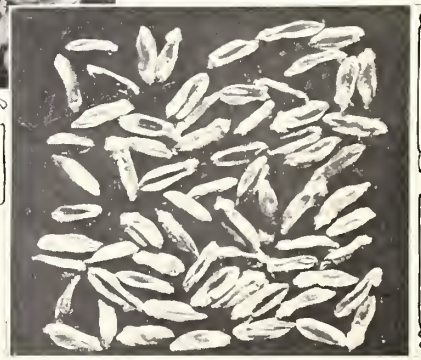
Black Stem Rust as it appears on the leaves of the Common Barberry



Enlarged single leaf



Plump healthy grain



Shriveled rusted grain

## DANGEROUS NEIGHBORS



Common Barberry Bushes growing near grain fields



Report Common Barberry bushes you may find to your State Leader of Barberry Eradication.



Common Barberry is harmful, destroy



Japanese Barberry is harmless, do not destroy







FLOWERS  
(yellow)

BERRIES  
(bright red)

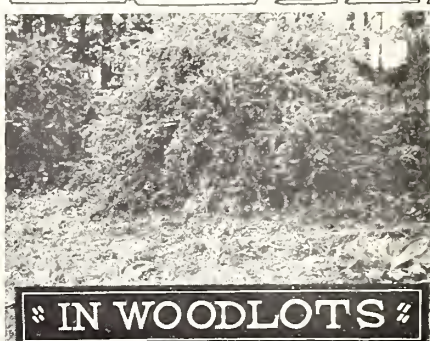
## Where Barberry Bushes Grow



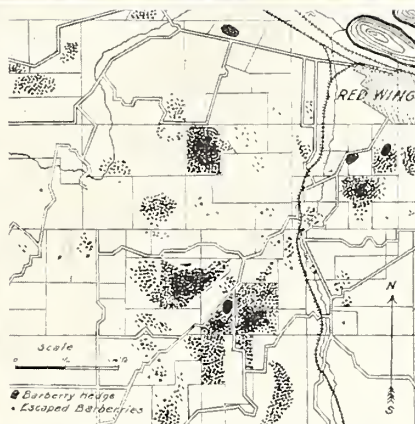
IN DOORYARDS



BIRDS CARRY BARBERRY SEEDS SEVERAL MILES, DROPPING THEM AMONG ROCKS AND IN OUT-OF-THE-WAY PLACES



IN WOODLOTS



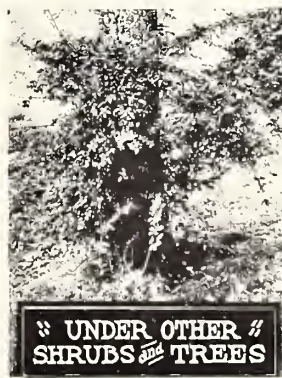
Barberries spread by birds



ON ROCKY HILLSIDES



AS HEDGE FENCES



UNDER OTHER  
SHRUBS AND TREES

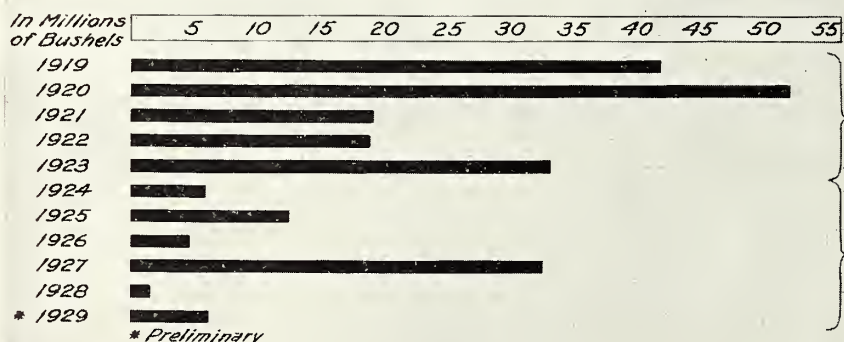






## Common Salt Kills Barberry Bushes and Prevents Sprouting

### Wheat Losses in Barberry Eradication Area, 1919-1929

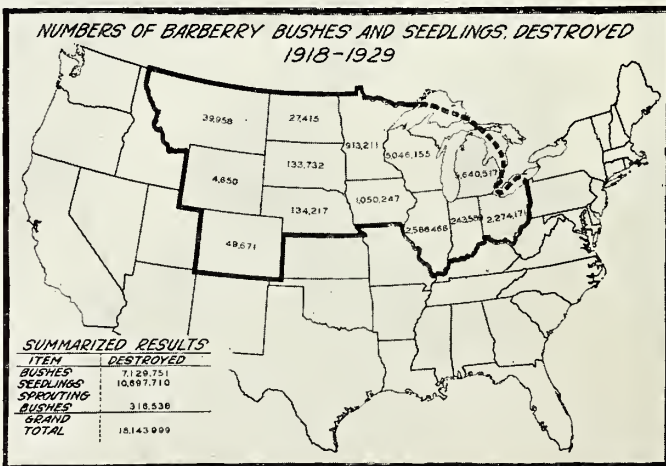
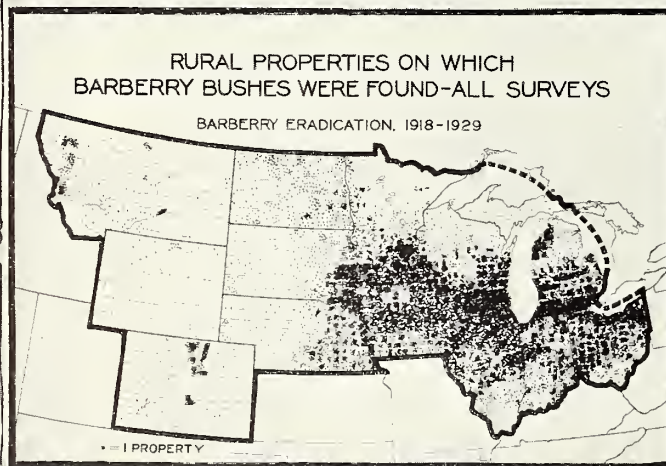


The average annual loss for the first five year period, 1919 to 1923, was approximately 33,000,000 bushels.

The average annual loss for the next six year period, 1924 to 1929, was approximately 10,500,000 bushels.

The losses to small grain crops caused by black stem rust have been reduced since the beginning of the barberry eradication campaign in 1918. The breeding of rust-resistant varieties, the use of early maturing varieties, and the sowing of crops early, have aided barberry eradication in this reduction.

## "BARBERRY ERADICATION PAYS"

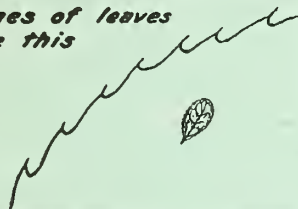


Prepared by the Rust Prevention Association, 300 Lewis Building, Minneapolis, Minn., in co-operation with Bureau of Plant Industry, U. S. Department of Agriculture, Washington, D. C.

# Common Barberry Spreads Black Stem Rust

*When you find  
a spiny bush  
with -*

*Edges of leaves  
like this*



*Spines like these*



*Berries like these*



*Inner bark yellow*



*It is a  
Common Barberry  
and should be  
reported at once*

**Know  
Common  
Barberry**

***Look For It!***

*Spread of  
Barberries by  
birds*

*Birds eat the  
berries*



*Carry them to their  
roosting places*



*Where they cough  
up the seeds*



*From which seedling  
bushes grow*



*They in time  
bear fruit which  
is again carried  
farther on*

**Look For and Report All Common Barberry Bushes**

***To the Barberry Eradication Office, in care of your State Department  
of Agriculture or your State Agricultural College***

# Common Barberry Bushes

*spread*

## *Black Stem Rust*

*to*

WHEAT, OATS,  
BARLEY, RYE,  
*and* Many Wild  
Grasses

**THIS** Study Guide is prepared and printed by the Bureau of Plant Industry, U. S. Department of Agriculture, Washington, D. C. The cover is furnished by the Conference for the Prevention of Grain Rust, 300 Lewis Building, Minneapolis, Minnesota.



A LESSON PLAN BY WHICH NORTH DAKOTA TEACHERS MAY PRESENT THE SUBJECT "BLACK  
STEM RUST AND THE COMMON BARBERRY."

To the teachers of North Dakota:

The enclosed lesson plan for the teaching of the story of the common barberry and its relation to the spread of black stem rust of grains has my approval and endorsement.

Very sincerely yours,

BERTHA R. PALMER

Bertha R. Palmer, Superintendent,  
Department of Public Instruction.

Furnished to the schools of North Dakota by the Division of Barberry Eradication, Bureau of Plant Industry, United States Department of Agriculture, in cooperation with the State Agricultural College, Fargo, North Dakota, the Conference for the Prevention of Grain Rust, 300 Lewis Building, Minneapolis, Minnesota, and the State Department of Public Instruction, Bismarck, North Dakota.

The following lesson plan has as its basis a general lesson plan prepared by Donald G. Fletcher<sup>1</sup> and Noel F. Thompson<sup>2</sup>. It has been revised and adapted to the needs of North Dakota schools by George C. Mayoue<sup>3</sup> and Edward M. Yocum<sup>4</sup> with the aid of the following State Officials and educators:

Miss Bertha R. Palmer, State Superintendent of Public Instruction in North Dakota.

President George A. McFarland of the Minot State Teachers College.

Miss Elsie J. Cook, critic of the Minot State Teachers College, and President of the North Dakota Parent-Teachers Association.

1. Secretary of the Conference for the Prevention of Grain Rust, 300 Lewis Building, Minneapolis, Minnesota.

2. Formerly Associate Pathologist, Division of Cereal Crops and Diseases, Bureau of Plant Industry, U. S. Department of Agriculture.

3. Associate Pathologist in Charge of Barberry Eradication in North Dakota.

4. Formerly Agent, Division of Cereal Crops and Diseases, U. S. Department of Agriculture.

## LESSON PLAN

A plan by which the teachers of North Dakota may be guided in presenting the essential facts concerning stem rust and its prevention through the eradication of the common barberry.

### Teacher's Aim:

(1) To become familiar with the common barberry and its relation to black stem rust, and (2) to impart this information to the students.

### Student's Aim:

(1) To learn the essential facts concerning the life history and the importance of black stem rust; (2) To learn to recognize the common barberry and distinguish it from other shrubs, including the Japanese barberry; (3) To learn to recognize the four stages of stem rust; and (4) To disseminate this information in the community.

### Possible Correlations

The study of the common barberry may be advantageously included in the study of any or all of the following subjects: Botany, Biology, Agriculture, General Science, Nature study, Language, Arithmetic, Geography, and Spelling.

### Definitions

Before beginning the study of black stem rust the following definitions should be mastered:

**PARASITE:** A living organism, either an animal or a plant, that lives on or in some other organism from which it derives its nourishment for the whole or a part of its existence. It produces no food of its own. A plant parasite, then, is a plant which steals its food from another living plant. Most such parasites are fungi, but not every fungus is a parasite as some are called saprophytes because they live on dead material.

**FUNGUS:** A fungus is a plant devoid of green coloring matter. Unlike green plants, it does not produce its own food materials, but obtains them from living or dead organic matter. It reproduces usually by means of spores. Examples of fungi: Toadstools, puffballs, bread molds, smuts, rusts, etc.

**SPORE:** A spore is a minute reproductive body or cell. It might very well be called the seed of a fungus.

**HOST or HOST PLANT:** Host plant is a term applied to the plant on or in which a parasite lives and from which it gets its food.

**LIFE CYCLE:** The life cycle of a plant or animal is the series of stages through which it passes before completing its full development.

Examples: An example of this can be found in the four stages of the life cycle of the butterfly. First, the egg, then the worm, next, the pupa, and finally, the butterfly. Black stem rust furnishes one of the best examples of the life cycle of a parasitic fungus.

### Sources of Information

United States Department of Agriculture Farmers' Bulletin 1544, and Department Circulars 269 and 356. North Dakota Extension Circular No. 73. Pamphlets prepared by the Conference for the Prevention of Grain Rust, 300 Lewis Building, Minneapolis, Minnesota, an agency cooperating with the United States Department of Agriculture and the States.

### Suggestions to the Teacher

The loss of grain in the principal grain-growing areas of the United States from black stem rust has increased greatly in the past fifty years somewhat in proportion to the number of common barberry bushes. These bushes were introduced and planted as shrubbery and hedges but their seeds have been scattered by birds and cattle to waste land and wooded areas. Almost every farmer who has raised grain has suffered losses from black stem rust. Effective control of this disease is of vital interest to American agriculture. It is of special importance in North Dakota where so much spring wheat is grown.

Small grains are attacked also by several other plant diseases which in some sections cause severe damage. The diseases most easily confused with stem rust are the leaf rusts of cereals, including crown rust of oats. Where the leaf rusts occur, pupils should be taught to distinguish between the leaf rusts and black stem rust, which is the only grain rust spread by the common barberry.

Read the bulletins carefully. Familiarize yourself with the answers to the questions. Allow the pupils to study the material, the bulletins, and the charts, before beginning any discussion on the subject. Divide the study questions into several recitation periods as thought best. Emphasize the identification of the common barberry bush. Have the pupils bring to school samples of any bushes they believe to be the common barberry and, if necessary, send the samples to the Biology Department, State Agricultural College, Fargo, North Dakota, for identification. Encourage the pupils to ask their parents about black stem rust and the damage it does. Explain carefully the relation of the common barberry to this rust. Point out clearly that the destruction of every common barberry is absolutely necessary for the successful control of black stem rust. Encourage the pupils to look for barberry bushes. When one is found, let all the neighbors see it and then report its location to the Barberry Eradication Office, Box 1777, Fargo, North Dakota.



## A. Relation of Common Barberry to Black Stem Rust

Question 1. What is black stem rust?

Answer - Black stem rust is a fungous parasite which attacks wheat, barley, oats, rye and many of the tame and wild grasses.

References - N. Dak. Extension Circular No. 73, p. 5; U. S. Department of Agriculture Farmers' Bulletin No. 1544, pp. 4 - 8; Department Circular 269, p. 12; Department Circular 356, p. 1.

Q. 2. Explain why and how the kernels are shriveled when rust attacks the plant severely.

A. - The rust attacks the grain plant and robs it of the food which is intended for the development of the kernels. As a result these kernels are under-nourished, and shriveled from lack of food.

Ref. - N. Dak. Extension Circular 73, p. 8.

Q. 3. Name the four stages in the life cycle of stem rust.

A. - The four stages of black stem rust are:

(1) The yellow cluster-cup or spring-spore stage. Develops only on the barberry bush. Produces yellow spores.

(2) The red or summer-spore stage. Develops only on grains and grasses. Its reddish-brown spores spread to other grains and grasses and produce a second crop. In like manner, successive crops of summer spores develop about every ten days throughout the summer.

(3) The black or winter-spore stage. Develops only on grains and grasses. Follows the summer stage, producing its black spores in the red-spore pustules or in new pustules.

(4) The colorless-spore stage. Produced in the early spring by germinating black spores. These colorless spores infect only the barberry, producing the cluster-cup stage.

Ref. - N. Dak. Extension Circular 73, p. 5; Farmers' Bulletin 1544, pp. 4 - 8; Department Circular 269, p. 12; Department Circular 356, p. 2.

Q. 4. Why will the eradication of the common barberry in North Dakota and adjacent States tend to stop destructive stem-rust epidemics?

A. - Without the common barberry, the black-spore stage which lives over the winter on straw, stubble, and wild grasses can not infect grains and grasses. The red stage, which can infect grain directly, does not live over winter in these States.

Ref. - N. Dak. Extension Circular 73, p. 6.

Q. 5. What effect does hot, wet weather have on black stem rust?

A. - Hot, wet weather speeds up the production of rust spores which enables the rust to spread rapidly.

Ref. - N. Dak. Extension Circular 73, p. 7.

Q. 6. What color is the rust produced on a grain plant after it becomes infected by the spores from a rusted barberry bush?

A. - The first stage of the rust which appears on grain plants is brick red.

Ref. - N. Dak. Extension Circular 73, p. 7.

Q. 7. How is rust spread from the barberry to grains and grasses?

A. - The rust is spread from the barberry to grains and grasses by tiny spores carried by the wind. These spores are so small that they can not be seen with the naked eye.

Ref. - N. Dak. Extension Circular 73, p. 7.

Q. 8. Can this red rust on the grain plants infect other grain plants? Does stem rust produce one crop or more than one crop of red spores during the summer? How often may a new crop of red spores be produced if weather conditions are favorable?

A. - Yes, the red rust of the grain plants can infect other grain plants by means of the red spores. Stem rust may produce a number of crops of red spores during the summer, the number depending on weather conditions. Under favorable weather conditions a new crop of red spores may be produced every seven to ten days. Each new spore may infect another plant and thus aid in the spread of rust.

Ref. - N. Dak. Extension Circular 73, pp. 6 & 7.

Q. 9 Can black spores directly infect grains and grasses?

A. - No, black spores can not directly infect grains, they are the resting spores by which the rust survives the winter.

Ref. - N. Dak. Extension Circular 73, pp. 6 & 16; Farmers' Bulletin 1544 p. 8.

Q. 10. Can the black spores directly infect the barberry?

A. - No, the black spores germinate and produce the colorless spores which infect the common barberry.

Ref. - Department Circular 356, p. 2.

Q. 11. What are the only plants that can be infected by the colorless spores of black stem rust?

A. - Only some plants belonging to the Barberry family.

Ref. - N. Dak. Extension Circular 73, p. 6; Farmers' Bulletin 1544, pp. 8 & 9.

Q. 12. Do all kinds of barberries spread black stem rust?

A. - No. The Japanese barberry does not spread stem rust.

Ref. - N. Dak. Extension Circular 73, p. 5, Farmers' Bulletin 1544, p. 19.

Q. 13. What is one of the best methods of controlling black stem rust?

A. - The eradication of the common barberry is one of the best methods of controlling stem rust in both the Northern United States and many foreign countries because the red spores do not live through the winter in the Northern States, and because the black spores and the colorless spores are harmless without the barberry.

Ref. - N. Dak. Extension Circular 73, p. 8; Farmers' Bulletin 1544, pp. 8 & 24. Department Circular 269.

Q. 14. Would the eradication of all the common barberries on one farm protect the grain on that farm from black stem rust?

A. - No; because spores of stem rust may be blown from barberries or rusted grain on other farms. Rust spores, being very small, may be carried by the slightest breeze.

Ref. - General information from all bulletins.

Q. 15. Could the barberries in the neighboring States produce rust which might spread to the grain in this State?

A. - Yes, under favorable weather conditions it is very likely that spores from barberry bushes in one State could be blown into another State and cause rust infections.

Q. 16. What have other countries done to control black stem rust?

A. - Several foreign countries, notably Denmark, have passed laws compelling the destruction of the common barberry. In each of these countries serious damage from black stem rust no longer occurs.

#### B. Losses Caused by Black Stem Rust

Q. 1. Why is the market value of shriveled grain greatly reduced? (Compare a sample of rust-shriveled grain with a sample of plump grain which has not been damaged by rust.)

A. - Shriveled grain is not as heavy as the plump grain and its value is also reduced by the fact that it is not well suited for milling purposes.

Go to your local elevator and inquire the market price of wheat weighing 58 pounds to the bushel and wheat weighing 48 pounds to the bushel. (Wheat that has been attacked by rust very often weighs ten or more pounds less than wheat which has been free from rust and other diseases.)

Q. 2. What is the average annual stem-rust loss in the United States? In North Dakota?

A. - The average stem-rust loss to small grains in the United States is estimated at nearly 43,000,000 bushels annually for the 16-year period 1915 to 1930 inclusive. In North Dakota alone in the same period the average annual loss is estimated at about 14,000,000 bushels.

Ref. - N. Dak. Extension Circular 73.

Q. 3. - Has barberry eradication reduced stem-rust losses in North Dakota?

A. - Yes. Although the campaign to remove all of the barberries is far from completed, stem-rust epidemics have become less severe and the general annual occurrence of stem rust has been considerably later.

#### C. Identification of Common Barberry

Q. 1. Describe the appearance of the common barberry bush as to shape and size.

A. - The common barberry is an erect shrub of graceful habit. It ranges from a seedling bush of a few inches to a mature shrub of possibly



twelve or more feet. The color of the leaves is a dull green. There also is a variety of the common barberry which has purple leaves.

Ref. - N. Dak. Extension Circular 73, pp. 3 and 6; Department Circular 356, p. 2.

Q. 2. Describe the outer bark, inner bark, leaves, thorns, flowers, and berries of the common barberry.

A. - The outer bark is grayish in color and is furrowed, the inner bark a bright yellow. The leaves normally are produced in clusters. They always have bristle-toothed edges. The three-pointed thorns occur at the base of the leaf clusters. The flowers are yellow. The berries are green in the summer and red in the fall and winter. They are produced in drooping bunches like currants.

Ref. - N. Dak. Extension Circular 73, pp. 4 and 6; Department Circular 356, p. 2.

Q. 3. Compare the bark, branches, leaves, flower clusters, and berries of the common barberry with those of the Japanese or harmless barberry.

A. - The bark of the common barberry is gray and furrowed in comparison with the reddish-brown, smooth bark of the Japanese barberry. The branches of the common barberry grow erect but those of the Japanese barberry are spreading, rarely attaining a height of over four feet. The leaves of the common barberry have bristle-toothed edges; those of the Japanese barberry have smooth edges. The thorns of the Japanese barberry usually occur singly at the base of the leaves. The flower clusters and the berries of the common barberry grow in bunches like currants while on the Japanese barberry the flowers and berries appear singly or in pairs.

Ref. - N. Dak. Extension Circular 73, pp. 4 and 6; Department Circular 356, p. 3.

#### D. Other Methods of Black Stem Rust Control

Q. 1. What effect does the early planting of spring grain have on the control of stem rust?

A. - The early planting of spring grain may help it to mature earlier and thus escape the late epidemics of stem rust.

Q. 2. How can the farmer help the grain to get a good start so that it can ripen before the rust damages it?

A. - Proper crop rotation, proper fertilizers, thorough preparation of the seed bed, early seeding and the use of early and best adapted varieties of grain will aid in the production of a sturdy plant which is less likely to be attacked by rust than weaker plants.

Q. 3. Are there varieties of spring wheat that are more resistant to stem rust than others? What are they?

A. - Most of the varieties of red hard spring common wheat are more susceptible to black stem rust than are the durum wheats. Of the durums, Monad and Nodak are more resistant than Kubanka and Arnautka, the standard varieties. Of the common varieties, Kota and Ceres are more resistant to stem rust than Marquis, the most widely grown of spring wheats.



E. The Introduction and Distribution of the  
Common Barberry in the United States.

Q. 1. Is the common barberry native to the United States?

A. - No.

Ref. - N. Dak. Extension Circular 73, p. 3.

Q. 2. Where did the common barberry come from and how has it been distributed throughout the country?

A. - The common barberry is thought to be native to the mountains of middle and western Asia where it was used by man as a medicinal plant. As civilization advanced, the bush was carried either by root or seed wherever the new settlers went. In addition to the use of its leaves and bark for medicinal purposes, the berries have been used in making jellies and wines, and the yellow roots made into dyes. Later the shrub was used as a hedge fence and for ornamental purposes. For this latter use it was commercialized by nursery companies and sold throughout the United States.

Ref. - N. Dak. Extension Circular 73, p. 3.

Q. 3. Are there any harmful barberries native to North America?

A. - Yes, two species of harmful barberry have been found to be native to North America. Neither of these species is native to North Dakota. One of the native species, called Berberis canadensis, has been found in Illinois, Indiana, and Kentucky and in the Allegheny Mountains. The second species, Berberis fendleri, has been found in Colorado and other Rocky Mountain States.

Q. 4. By what means are the seeds of the common barberry scattered from a seed-bearing bush?

A. - The barberry seeds are scattered principally by birds, but also by cattle and other animals, by man, and by running water.

Ref. - N. Dak. Extension Circular 73, p. 11.

Q. 5. How long do barberry seeds lie in or on the ground before germinating? How does this increase the difficulty of barberry eradication?

A. - Barberry seeds have been known to lie in or on the ground for as long as six years before germinating. For this reason several reinspections of properties on which bushes have been destroyed are necessary.

Ref. - N. Dak. Extension Circular 73, p. 12.

F. The Eradication of the Common Barberry

Q. 1. Does North Dakota have a law condemning the common barberry?

A. - Yes. This law was passed in 1917. Similar laws are in force in each of the other States in the barberry eradication area.

Ref. - N. Dak. Extension Circular 73, p. 3.

Q. 2. How are common barberry bushes killed?

A. - Common barberry bushes may be killed by digging or by the application of salt or kerosene to the base of the bushes.

Ref. - N. Dak. Extension Circular 73, pp. 14 and 15; Department Circular 356, p. 3.

Q. 3. Why is digging often unsatisfactory?

A. - Digging is unsatisfactory because a small root fragment left in the ground may produce sprouts which will spread stem rust?

Ref. - N. Dak. Extension Circular 73, pp. 14 and 15; Department Circular 356, p. 3.

Q. 4. Why is it necessary to revisit properties even after the original barberry bushes have been removed?

A. - Because the seeds may lie in or on the ground for a period of several years before germinating and also because bushes that have been dug very often produce sprouts.

Ref. - N. Dak. Extension Circular 73, p. 14.

Q. 5. Why must care be exercised in placing salt or kerosene on barberry bushes growing in a lawn?

A. - Salt or kerosene placed upon barberry bushes growing in a lawn or hedge also kill valuable shrubbery or other vegetation within an area of five or six feet. For this reason care must be used in the application of these two chemicals.

Ref. - N. Dak. Extension Circular 73, p. 14; Department Circular 356, p. 4.

Q. 6. If you find a bush which you think is common barberry, to whom would you send a sample for definite identification?

A. - Samples of bushes suspected to be common barberry will be identified free of charge if they are mailed to the Biology Department, State College Station, Fargo, North Dakota.

Q. 7. If you find a bush which you think is common barberry, should you destroy it?

A. - No one should destroy any shrubbery until the sample of it has been properly identified. In this way valuable hedges and shrubbery will not be destroyed by mistake.

### PRACTICAL EXERCISES

Ask the pupils to bring in some of the black stage of the rust which is present on the stubble of most grain fields. Examine the rusted straw under a hand lens or microscope. Notice how the rust has broken through the straw. Scrape some of the black spores from the stem into a drop of water on a glass slide. Place a cover glass on the material and examine under the microscope. Note that the black spores are two-celled. Note their comparatively thick walls. Each cell of a black spore may germinate in the spring and produce the tiny colorless spores which infect the common barberry.

If the red or summer stage of the rust is available, prepare a microscope slide of it. Compare the size, shape and color of these spores with the black spores. Note that the red spores are only one-celled and are oval in shape. Note, too, that the walls on the red spores are thin. It is for this reason that these spores soon dry out or are killed quickly by cold weather.

Have the pupils draw a twig of the common barberry showing the chief characteristics by which the bush may be identified.

Examine a group of cluster cups on a barberry leaf. An average-sized cluster-cup contains from 8,000 to 15,000 spores, so that a moderately infected common barberry bush six feet high may produce hundreds of millions of black stem-rust spores.

### CORRELATIONS

#### Language

Write a letter asking for bulletins on barberry eradication. Write a letter to some farmer telling him about the relation of the common barberry bush to black stem rust. Have the pupils write sentences containing the words suggested for a spelling lesson.

#### Arithmetic

The following figures were obtained by actual counts made on a common barberry bush of medium size:

Total number of leaves.....	35,000
Percentage of leaves showing rust.....	80
Average number of rust clusters on each infected leaf	8
Average number of cups in each cluster.....	36
Average number of spores in one cup of a cluster.....	11,500

Q. 1. How many rusted leaves would there be on the average-sized bush?  
A. - 28,000

Q. 2. How many clusters of cluster-cups would there be on the average-sized bush?  
A. - 224,000.

Q. 3. How many cluster-cups would there be on each leaf?  
A. - 288.

Q. 4. How many cluster-cups would there be on the entire bush?  
A. - 8,064,000.

Q. 5. How many spores would be produced on the entire bush?  
A. - 92,736,000,000.

Q. 6. If the wind distributed these spores so that one fell on each square inch of land surface, how many acres would the spores from this bush cover?

A. - 14,784 acres.

Q. 7. How many square miles is this?  
A. - 23 square miles.



Q. 8. How many barberry bushes would it take to produce one spore for every square inch of land surface in your county?

Q. 9. What is the damage in dollars that has been traced to rust spread from a single common barberry?

A. - The damage traceable to a single bush is very hard to determine because of the long distance which spores may be blown. However, damage to the extent of \$50,000 was definitely traced to a single common barberry in Indiana.

Combined with the following facts, some amazing results may be obtained. A single red rust spot on a grain plant may contain one hundred thousand spores, each capable of causing more rust on the same or other grain plants. From the time infection occurs until a new crop of spores is formed about ten days have elapsed. Each of the new spores may repeat the process. In ordinary seasons at least four to six crops of red spores may be produced between the time the barberry begins spreading rust and the time of harvest. Fortunately, many of the spores produced fail to survive.

### Geography

Study the area in which the barberry eradication campaign is being carried on. Where is most of our spring wheat grown? Winter wheat? Give reasons for clearing this area of all common barberry bushes.

### Spelling

barberry	destructive	cooperation	chemical	germinating
eradication	disease	campaign	kerosene	common
destroys	epidemic	yield	average	European
stem rust	damage	weather	production	grain
spore	agriculture	reduced	escaped	sprouts
Japanese	cluster-cup	spine	prevention	resistant
furrowed	wheat	inoculum	distribution	bristle-toothed

### Single Word Answer Test

Directions: Write one word as an answer to each of the following questions.

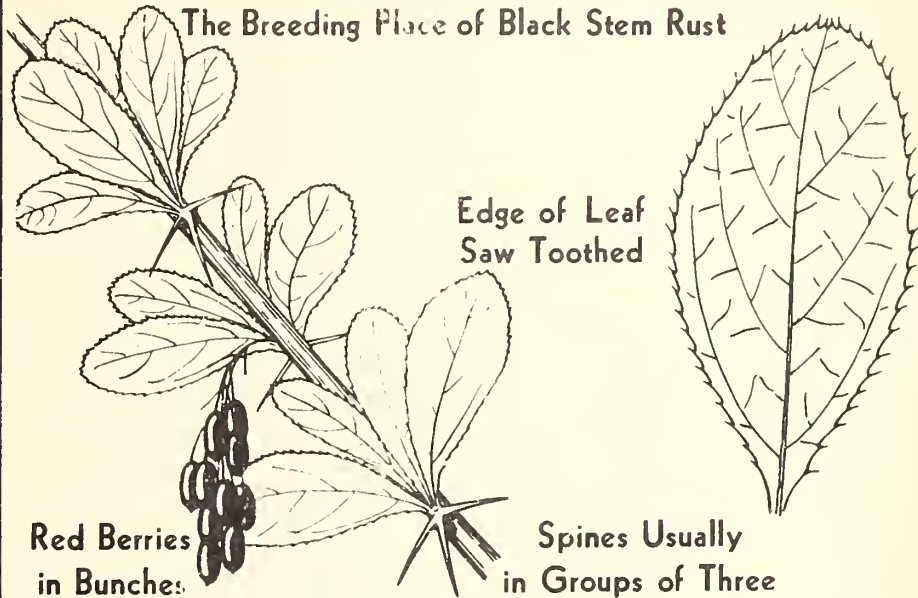
1. What type of food plants does black stem rust attack? Ans. Grain.
2. How many kinds of grain are attacked? Ans. Four.
3. What stage of black stem rust lives through the winter? Ans. Black.
4. What stage of black stem rust occurs on the barberry? Ans. Cluster-cup.
5. What stage of stem rust spreads from field to field? Ans. (Red (or summer)).
6. What kind of barberry spreads stem rust? Ans. Common.
7. What is the nature of the edges of its leaves? Ans. Bristle-toothed.
8. What kind of a plant is common barberry -tree, shrub, or herb? Ans. Shrub.
9. What other kind of barberry is commonly grown? Ans. Japanese.
10. What common chemical is effective for killing common barberry? Ans. Salt.



## COMMON BARBERRY

HARMFUL

The Breeding Place of Black Stem Rust



Edge of Leaf  
Saw Toothed

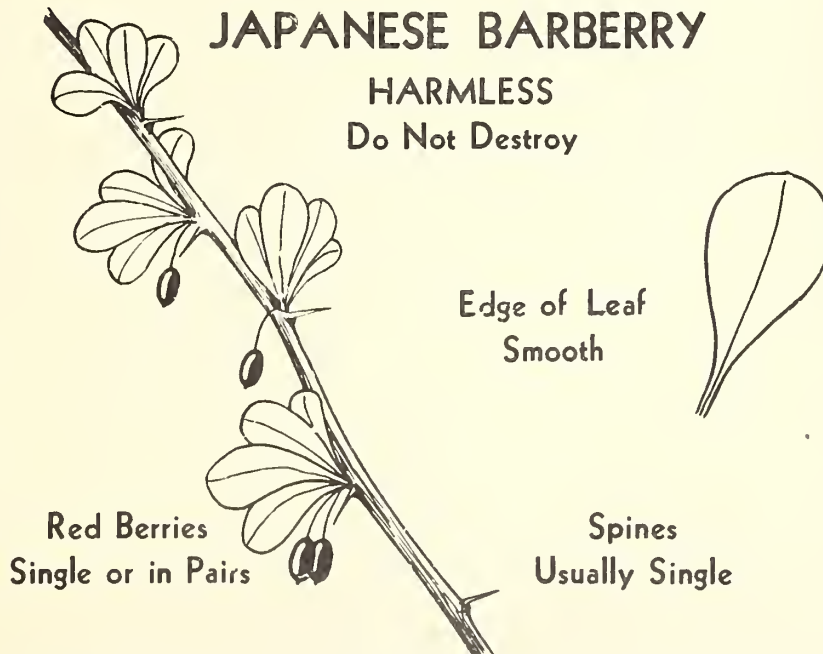
Red Berries  
in Bunches

Spines Usually  
in Groups of Three

## JAPANESE BARBERRY

HARMLESS

Do Not Destroy



Edge of Leaf  
Smooth

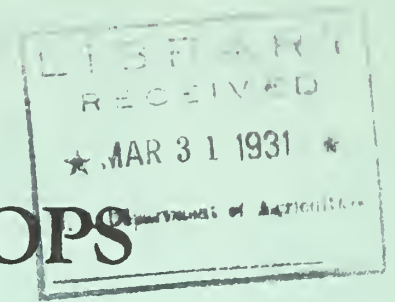
Red Berries  
Single or in Pairs

Spines  
Usually Single



1.9  
p 69 BLP

# PROTECT OUR GRAIN CROPS



*from*

## ***BLACK STEM RUST***

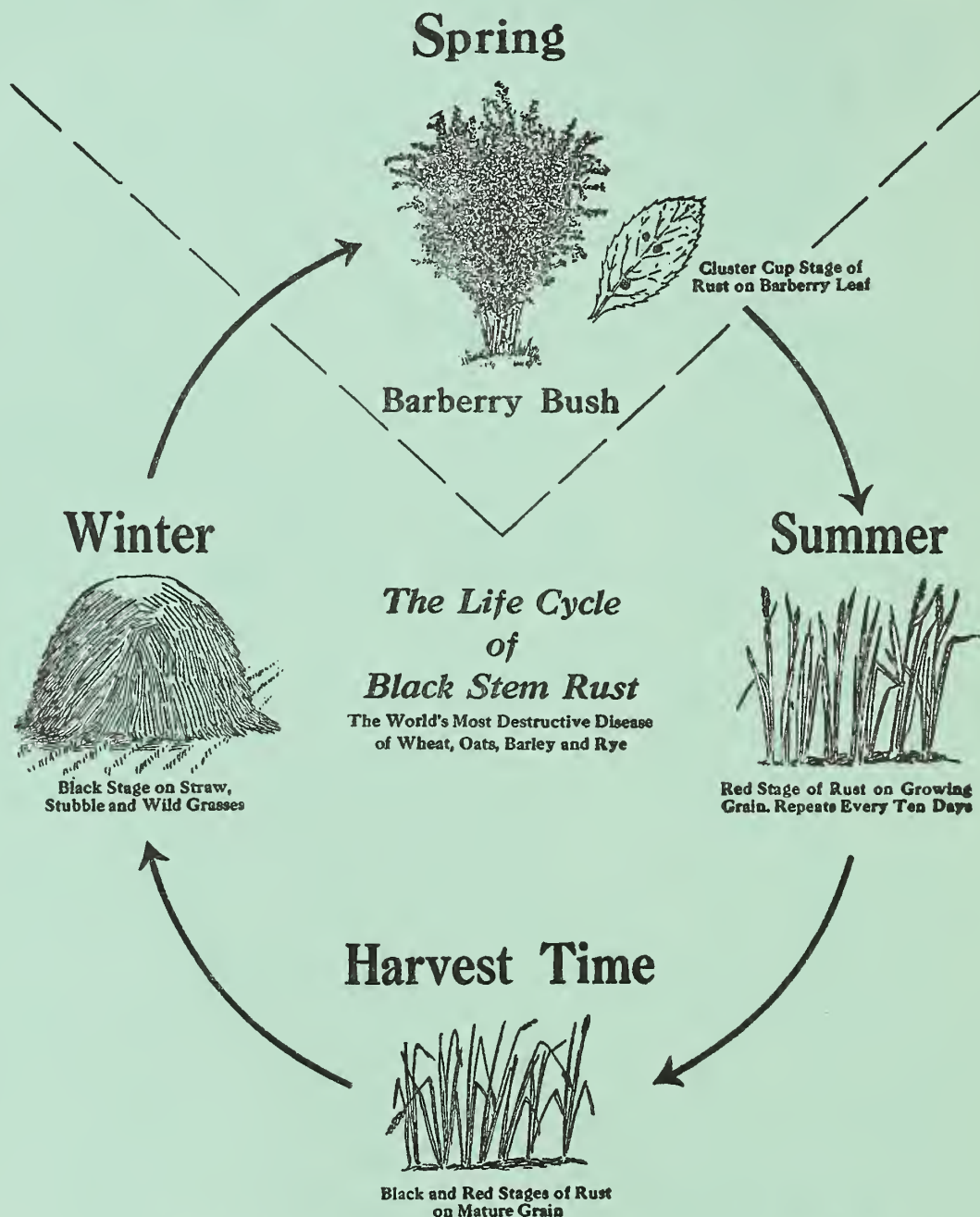


***Black Stem Rust, the Grain Grower's Worst Enemy, Must Be Controlled***

**A Guide for the Study of Black Stem Rust of Small Grains  
and Its Relation to Common Barberry Bushes**



# Remove the Barberry and Break the Rust Cycle



All Common Barberries act as starting points for Black Stem Rust early each spring. By destroying the barberry the early spring source of black stem rust is eliminated. The Common Barberry provides a means to bridge the gap between the black stage of the rust on grain in the fall and the red stage on grains and grasses the following spring.

**BOOST BARBERRY ERADICATION—A PRACTICAL RUST CONTROL MEASURE**



THE ERADICATION OF THE COMMON BARBERRY

A lesson plan for teachers in Illinois.

Issued by the Office of Barberry Eradication  
Bureau of Plant Industry  
U. S. Department of Agriculture  
1931

"The destruction of all common barberry bushes is a huge task. Good citizenship means cooperation."

# THE ERADICATION OF THE COMMON BARBERRY

## How to Use These Plans

Design: To meet the needs of the recitation type of class, but could be adapted to the group or contract type, being given as problems.

Arrangement: Arrangement of lesson topics is in accordance with the logical sequence of procedure and anticipates questions as they would arise in the mind of the student.

Study Date: Lessons should be taken up in the spring at the time when bushes have leaves and conditions are right for field trips. Spring and summer may then be used by students in their follow-up work.

Texts: A convenient booklet is published by the United States Department of Agriculture as Miscellaneous Publication No. 7, January, 1928, entitled "Bread or Barberries." Page references are given in the plans to this publication and also to U. S. Dept. Agr. Circ. 356, entitled "The Common Barberry and How to Kill It." It is suggested that enough of these be secured for the entire class.

Materials: Pamphlets and posters may be obtained from your State Agricultural College. Help the Government distribute posters by tacking them up in conspicuous places in the community when the class is through with them.

Assignments: Assignments should be made the day previous to the recitation. Assignments for advance work are important. Special care should be used to make everything clear, as this will increase the efficiency of the students' study time and increase the value of the recitation period. The points listed under "A. To stimulate interest" will stimulate in the child a desire to study the assignment.

Aims: Both teacher and pupil should have in mind a definite aim while studying each lesson. The pupil's aim should be suggested while making assignment.

Double-column Guide: This guide to recitation gives the teacher definite information opposite each question - at all times ready reference for those teachers not familiar with the technical phases of the subject.

Time: If the suggested time for each division of the lesson plan is carried out, it is believed better results will be obtained.

### Assignment for Lesson 1.

#### Black Stem Rust and the Resulting Economic Losses.

##### A. To stimulate interest:

What things do you eat containing products made from wheat or other small grains?

What does black stem rust do to the grains?

Why is grain important?

##### B. Reading matter:

Read pages 8, 9, 10, and 11 of U. S. Dept. Agr. Misc. Pub. 7, "Bread or Barberries."

- C. Pupils Aim:  
To learn to what extent black stem rust is affecting small grains.

## LESSON 1

Assignment for Lesson 2: (2 minutes)

### Black Stem Rust and How it Lives

- A. To stimulate interest:  
What is black stem rust?  
Where does it live?  
What plants does it live upon?
- B. Reading matter:  
Answers will be found on pages 1 - 6 of U. S. Dept. Agr. Misc. Pub. 7, "Bread or Barberries."
- C. Pupil's Aim:  
Let us try to find out how and where this enemy is living.

Today's Lesson:

### Black Stem Rust and the Economic Losses it is Producing

- A. Aims:
1. Teacher: To bring to the student the fact that black stem rust is causing tremendous losses to our grain crops, and that if allowed to continue and increase it will constitute a serious menace to our national supply of food.
  2. Pupil: To learn to what extent black stem rust is affecting the small grains.

Materials Needed:

- A. Samples - Black stem rust on stems from local fields.  
Shriveled kernels of wheat, barley, rye, and oats. Perfect kernels of wheat, barley, rye, and oats. Cereal products - Rolled oats, flour, rye bread, etc.
- B. Posters - "What Black Stem Rust Does to Our Small Grains."

Introduction: (1 minute)

Black stem rust is a disease that affects grain, wheat, oats, rye, and barley and cripples them much as infantile paralysis cripples children. The United States Government and the State

Department of Agriculture, in cooperation with the Conference for the Prevention of Grain Rust, have issued a call to us, each of us, to come out and fight this grain disease. In order to be good soldiers we need to find out who, what, and where our enemy is. Today we shall discover to what extent grain rust is troubling our crops in the United States.

LESSON 1 Teacher's Guide to Recitation (17 minutes)

Answers and References	Main (Pivotal) Questions
1. Show specimens of different grain products.	1. What products do we make from perfect grains? (Allow student to name and then pick from your supply his specimen for exhibit to the class.)
2. Food - Man and Animal Textile) Paper ) Straw Alcohol - Legitimate uses Industry (Page 11 of "Bread or Barberries.")	2. Why are we dependent upon these grains?
3. Display samples, from local grain showing the effect upon the stem.	3. What does black stem rust look like?
4. Display grain kernels of as many different grains as you can obtain. Show perfect kernels and shriveled ones. If not able to obtain, show cut on page 10 of "Bread or Barberries."	4. What does it do to the grain? (a) Would these damaged kernels make good flour? Good cereals?
5. Colorado, Illinois, Indiana, Iowa, Michigan, Minnesota, Montana, Nebraska, North Dakota, South Dakota, Ohio, Wisconsin, Wyoming.	5. What States are most affected by grain rust? (a) Where are these States located? (b) Why are they most stricken?
6. Place before the student, the poster "What Black Stem Rust Does to Our Small Grains."	6. To what extent are these grain States affected? (a) Review State by State. (b) The average annual loss of wheat due to stem rust from 1916 to 1930, inclusive, is 28,000,000 bushels.



Answers and References	Main (Pivotal) Questions
7. U. S. Dept. Agr. Circ. No. 356 page 1.	7. The quantity of wheat lost in 1916 alone would make 11,000,000,000 loaves of bread.
8. Same poster as question 6.	8. What has this loss meant in dollars and cents? Average annual loss from 1916 to 1930, more than \$47,000,000.
9. Feed all hungry people in the United States and for- eign lands.	9. What could we do with this waste?
10. Become a national menace.	10. What will happen if we do not check the spread of black stem rust?
	11. Having used these posters, we shall display them in the community where people may see them.

## LESSON 2

Assignment for Lesson 3: (2 minutes)

History of Common Barberry

- A. To stimulate interest:  
How long has man known this plant?  
Why has it been cultivated although a pest?  
Of what use has it been?
- B. Reading matter:  
Find answers on pages 6, 7, 8, and 12 of "Bread or Bar-  
berries."
- C. Pupil's Aim:  
To look backward a few years and see if barberry toleration  
is worth what it costs.

Today's Lesson:

Black Stem Rust and How it Lives

A. Aims:

1. Teacher: To give a biological insight into the habits and life cycle of rust and to show that eradication of the common barberry will relieve the serious existing condition.
2. Pupil: To learn the habits and haunts of rust in order to combat this enemy in an intelligent way.

Materials Needed:

- A. Samples - Black stem rust on stems - local fields.  
Plate 3 - from "Conference for the Prevention of Grain Rust, Minneapolis."  
Plate 1 - The Life Cycle of the Black Stem Rust.  
Envelope containing common barberry and "cluster cups."

Introduction: (1 minute)

Having found yesterday that black stem rust is damaging our crops a great deal, today we wish to learn how we may best combat this enemy. Let's take an example: Suppose that in our town, people were suffering from mosquitoes a great deal. Mosquitoes hatch only in stagnant water. On the outskirts of town we find a few stagnant pools. Which is easier, to rid ourselves of the pools or of the mosquitoes? Perhaps by knowing the complete life habits of the rust, finding where it lives, we may deal with it likewise.

LESSON 2      Teacher's Guide to Recitation (17 minutes)

Answers and References	Main (Pivotal) Questions
<p>REVIEW - A short answer period not over 2 minutes in length, covering main points of yesterday's lesson.</p> <p>ADVANCE:</p> <ol style="list-style-type: none"><li>1. Have at hand the samples of rust on stems, used in yesterday's work. (a) It is a plant - fungus. (b) It does not manufacture its own food but steals it from living plants.</li></ol>	<p>Is plump grain important, and why? What is the worst grain enemy? What States are most affected?</p> <p>ADVANCE:</p> <ol style="list-style-type: none"><li>1. Why is this disease called a rust? (a) Is this disease a plant or an animal? (b) Why is this plant called a parasite?</li></ol>

Answers and References	Main (Pivotal) Questions
(c) People who are "spongers" on society.	(c) Do we have any human parasites?
2. One year.	2. How much time does it take to make a complete trip around the life cycle of the rust?
3. (a) Spring - Barberry only. (b) Summer - Grain and grass. (c) Fall - Grain and grass. (d) Winter - Grain and grass.	3. Name the four stages of its life. (a) What parts of the year do they occupy? (b) Where <u>only</u> does the rust live in the spring?
4. Supply class with a plate which shows stages. Plate 3.	4. Trace these stages on plates. Point out microscopic parts, and spores. Show that stage 5 is the same as stage 1.
5. Plate 1	5. Show life cycle on Plate 1.
6. Supply class with an envelope containing a sample of common barberry with "cluster cups."	6. How does rust appear on the common barberry? (Show envelopes.)
7. Wind carries thousands of spores from cluster cups.	7. How does this stage get to the grain?
8. The cluster-cup spores from the barberry may spread rust by direct infection to a distance of many miles. As soon as the red or summer stage of rust appears on grains or grasses the wind can again carry the red spores for miles and scatter them on grain fields. The production of red-rust spores on the grain is repeated every 6 to 10 days in favorable weather. Rust has been traced for more than 100 miles after starting from a single group of barberry bushes.	8. How large an area may be affected by the rust from one group of barberries?

Answers and References	Main (Pivotal) Questions
<p>9. Produces pustules on stems. This chokes the plant and prevents food from reaching kernels that are developing, by allowing the sap of the plant to evaporate through the rust pustule openings. Shriveled kernels result.</p> <p>10. The locations of common barberry bushes should be reported to the Office of Barberry Eradication, Post Office Building Urbana, Ill. so that the bushes may be destroyed before further damage occurs. (a) The common barberry.</p>	<p>9. How does the rust spoil the grain?</p> <p>10. Now what can we do? (a) Which home of the rust should be destroyed, the grain or common barberry?</p>

### LESSON 3

#### Assignment for Lesson 4: (3 minutes)

##### Identification of the Common Barberry

##### A. To stimulate interest:

Have you ever seen the common barberry?

Is it a large or a small plant?

How can you tell one when you see it?

In what way may it be distinguished from other shrubs?

##### B. Reading matter:

1. Description on page 2, U. S. Dept. Agr. Circ. 356.

2. Study samples in envelopes and make drawings of the leaves and spines.

3. Study Plate 4 (learn to recognize common barberry), and page 14 of "Bread or Barberries."

##### C. Pupil's Aim:

To learn to know the common barberry whenever seen.



History of the Common Barberry

A. Aims:

1. Teacher: To give to the student the facts regarding the common barberry which will help to dispel the traditional belief that the common barberry is an ornamental friend.
2. Pupil: To look backward a few years and determine whether barberry toleration is worth what it costs.

Materials Needed:

- A. "Bread or Barberries." U. S. Dept. Agr. Misc. Publ. 7.

Introduction: (1 minute)

From your reading you have gathered that the common barberry is not new to man. It has a checkered history. Is it worth to us all that it costs to tolerate it? By looking back over its records of the years, we should be able to sit as a jury, and determine the fate of the common barberry.

LESSON 3      Teacher's Guide to Recitation (16 minutes)

Answers and References	Main (Pivotal) Questions
REVIEW - A short answer period not over 2 minutes in length covering main points of yesterday's lesson (2).	Name four stages of rust life. How much time do they occupy? Where does the rust live in the spring? What does rust do to the grain?
ADVANCE: 1. 2,500 years, or more.	ADVANCE: 1. How long have men been acquainted with the common barberry?
2. Asia, India, Hindu writers.	2. In what country do we first hear of it? Who reported it?
3. Medicine from leaves and bark. Dyes and inks; yellow, green, red. Wood is tough, used for rake teeth. Leaves tender in spring, used as lemon juice is used; was acid; to make vinegar; make jam or jelly. Hedges - thorny.	3. Why was it important? How did men use it?

LESSON 3 Cont'd Teacher's Guide to Recitation (16 minutes)

Answers and References	Main (Pivotal) Questions
4. Seeds carried by man, birds, water, wind. Young plants transplanted by men.	4. How was common barberry spread throughout Europe?
5. Carried here as a friend by colonists.	5. How did it come to United States, where it was not native?
6. Lowell: "All down the loose walled lane in archin' bowers "The barb'ry droops its strings o' golden flowers."	6. What poet has mentioned the barberry?
7. Carried by pioneers. Used for hedges and shrubbery around houses.	7. How has common barberry spread to the Western States. For what used?
8. Noticed that if wind blew over hedge the grain on the windward side would rust.	8. How did men discover barberry - the traitor?
9. Destroyed barberry bushes, and no destructive rust appeared the following year.	9. What did they do, and what were the results?
10. It was not conclusive proof until scientists discovered the stages and habits as we learned them yesterday. (DeBary - 1865.)	10. Was this proof that common barberry bushes spread rust?
11. Barberry eradication organized in U. S. in 1918 - U. S. Dept. of Agr., in cooperation with the 13 North-Central States affected. Surveys have been made. Schools have been asked to help. Every common barberry must be found and destroyed.	11. What has been done?
12. Denmark eradicated the common barberry and now has no rust.	12. Has any country been successful in barberry eradication?

## LESSON 4

Assignment for Lesson 5: (2 minutes)

### Eradication of the Common Barberry

A. To stimulate interest:

There must be a vigorous campaign against any enemy if we expect victory.

Who is at the head of this campaign?

Who are the soldiers in this battle?

B. Reading matter:

1. Pages 13 - 14 of "Bread or Barberries."

2. Pages 3 - 4 of U. S. Dept. Agr. Circ. 356.

C. Pupil's Aim:

To determine who the leaders are in the struggle against the common barberry, and to find what part each individual will be privileged to play.

Today's Lesson:

### Identification of the Common Barberry

A. Aims:

1. Teacher: To bring before the student the characteristics of the common barberry and to distinguish it from the Japanese barberry.

2. Pupil: To learn to know the common barberry whenever seen.

Materials Needed:

A. Envelope containing barberry sample showing "cluster cups."

Introduction: (1 minute)

We have shown how dangerous an enemy the common barberry is; that it should be destroyed. We do not wish to kill harmless plants. We therefore must study the plant, preserve any other harmless plants, and prevent the escape of the enemy.

LESSON 4      Teacher's Guide to Recitation (17 minutes)

Answers and references	Main (Pivotal) Questions
REVIEW - A short answer period not	How long have men known barberry?

Answers and References	Main (Pivotal) Questions
<p>over 2 minutes in length covering main points of yesterday's lesson (5).</p>	<p>Of what importance was it? What are the harmful effects of barberry? Is the tolerance of common barberry worth what it costs?</p>
<p>ADVANCE: If possible it will be best to make this a field trip to some actual bushes and will be outlined as such. If feasible, have the county farm adviser or high school vocational agriculture teacher direct this trip. If a field trip is impossible, bring plants of common barberry and Japanese barberry to the room, or use plates provided by the U. S. Department of Agriculture.</p>	<p>ADVANCE: Designate a student to demonstrate each characteristic that you wish to point out. This should be passed around the class as much as possible, and not to one student only.</p>
<p>1. Wherever planted as an ornamental shrub or hedge in lawns and parks or where the berries have been scattered by birds. Along fences, under trees, along streams, woodlands, on hillsides, in pastures, and so forth.</p>	<p>1. What kind of a place does the common barberry choose in which to live?</p>
<p>2. 5 to 7 feet tall - sometimes 12 feet, very erect.</p>	<p>2. What is its habit of growth?</p>
<p>3. Grayish (outside); yellow (inside).</p>	<p>3. Color of bark? Outside? Inside?</p>
<p>4. Spines usually in groups of three to five, at base of leaf. But may have only one in some cases.</p>	<p>4. Where are the spines produced - how many?</p>
<p>5. Have bristle-toothed edges.</p>	<p>5. What are the peculiarities of the leaves?</p>
<p>6. Yellow.</p>	<p>6. What is the color of the flowers?</p>
<p>7. Clusters of berries - like currants, oblong shaped, bright red.</p>	<p>7. Does the bush have fruit? Describe.</p>



LESSON 4 Cont'd Teacher's Guide to Recitation (17 minutes)

Answers and References	Main (Pivotal) Questions
8. Same leaves, but yellow bark and roots.	8. Describe small sprouts and seedlings. Do you find any?
9. Yes. On underside of leaves.	9. Can you find any cluster cups of the rust?
10. No. Locate bush of Japanese barberry.	10. Should the Japanese barberry bush be destroyed?
11. Japanese rarely over 4 or 5 feet tall. Not erect - spreading. (a) Japanese - reddish. (b) Single usually, although more may occur (c) Smooth edges (d) Single, or two or three. Not in clusters.  (e) No.  (f) No. Save it.	11. What is the difference in habit between the two barberries? (a) Difference in bark? (b) Difference in spines? (c) Difference in leaves? (d) Difference in berries?  (e) Can you find any rust cluster-cups on the leaves of this plant?  (f) Is it harmful?

LESSON 5

Assignment for Lesson 6: (2 minutes)

Organizing for Action

- A. To stimulate interest:  
Does an army have organization?  
Must we not have organization?  
Should not the public be informed of what we are trying to do?
- B. Each student is to write a 200-word article on the barberry menace and what each citizen's responsibility is. The two best articles will be sent to the local newspaper on successive weeks (or days).

Eradication of the Common Barberry

A. Aims:

1. Teacher: To link the pupil's interest and knowledge with the constituted campaign against the barberry and to acquaint him with his privilege and duty.
2. Pupil: To determine who are the leaders against the common barberry, and to find out what part each individual will be privileged to play.

Introduction: (1 minute)

Victory never is won by passive resistance or cowardice. This nation does not make war on other nations, unless in defense, for we desire peace at all times. But we have been attacked by the common barberry and we must fight. The whole nation's agricultural outlook depends upon the successful eradication of the common barberry. Scientific study has shown that it should be killed, and our perusal of its history has convinced us that we must tolerate it no longer. We must discover our duty in this campaign.

LESSON 5                      Teacher's Guide to Recitation (17 minutes)

Answers and References	Main (Pivotal) Questions
REVIEW - A short answer period not over 2 minutes in length covering main points of yesterday's lesson (4).	Distinguish between the two barberries as to habit of growth. Distinguish between color of bark, leaves, spines, fruit. What should be our attitude toward the common barberry?
ADVANCE:	ADVANCE:
1. U. S. Department of Agriculture. (Point out that no better leader could be secured.)	1. Who is at the head of the campaign against the common barberry?
2. (a) 13 of the North-Central States where wheat is most grown. (b) The State Colleges of Agriculture.	2. Who are cooperating with the Government?

Answers and References	Main (Pivotal) Questions
<p>(c) Farmers, newspaper men, nursery men, teachers, and students.</p> <p>(d) State Agricultural Departments.</p> <p>(e) The Conference for the Prevention of Grain Rust, Minneapolis, Minnesota.</p> <p>3. (a) Learn to know the common barberry.</p> <p>(b) Report any bush you find to the County Agriculturist or State College of Agriculture and send a sample twig of the bush and its location to either office. The proper authorities will verify your identification and destroy the bush.</p> <p>(c) Tell the story of the harmful common barberry to anyone who does not understand it.</p> <p>(d) Report any severe outbreak of rust which occurs in your locality to either of the above offices.</p> <p>4. (a) By digging. (Use care to get all roots.)</p> <p>(b) Salt treatment.</p> <p>Bush with 12-inch base - 20 lbs.</p> <p>Bush with 6-inch base - 10 lbs.</p> <p>Put salt at base of all shoots.</p> <p>Keep farm animals away from salt, for they may die if they eat too much.</p> <p>(c) Kerosene.</p> <p>Bush with 12-inch base - 1 gal.</p> <p>Bush with 6-inch base - 2 qts.</p> <p>Drench ground around all shoots.</p> <p>5. Barberries near valuable shrubs or trees should not be killed with chemicals but should be dug.</p>	<p>3. How can we help?</p> <p>4. How may the common barberry bush be destroyed?</p> <p>(a) Name one method.</p> <p>(b) Name another.</p> <p>(c) Name another method.</p> <p>5. What precautions are necessary in chemical treatment?</p>

## LESSON 6

### Organization for Action

1. Take up papers prepared by class.
2. Introduction: (Not more than 5 minutes) Reserve plenty of time for organizing.

Now comes the test of our loyalty to community, State, and nation. Our study of the common barberry has shown that its eradication will benefit the world. The test of a good citizen is the way he applies himself to the tasks he knows he should do for the sake of his community. You may be good citizens by forming groups for barberry eradication. An army must have organization - so must we. And today if each of you is willing to go at this task whole heartedly, we will organize. You may form two groups, and may compete with each other for the spring and summer. We need a captain for each group; a name; a color; a secretary; poster men; and a display committee. This will give every one something to do.

As an added incentive and reward for the service which we shall render our State and nation, by reporting common barberry bushes, the Conference for the Prevention of Grain Rust will present a beautiful bronze medal to any boy or girl who reports a property on which such bushes are growing. A national organization known as the National Rust Busters Club has been formed of all the boys and girls who promise to "look for common barberry bushes, report them and tell every one how they spread black stem rust." Finding a property having common barberry gives anyone a life membership in the Club, as well as a beautiful medal. See how many medals each group can win.

Common barberry bushes may not be plentiful in your neighborhood. Since 1918, more than two and one-half million barberry bushes, sprouting bushes, and seedlings have been found and destroyed in Illinois, but the distribution has been irregular. Some regions have had many hundreds of bushes, while entire townships have been found to have none. It is very important to find one or two bushes in a region which is practically free. It is easier to keep a clean region free of common barberry bushes by being on the lookout for any that should be brought in by man or birds than to rid a badly infested area of all of the bushes which have become established there.



## Organization

Have class elect two captains.

Captains then choose their groups from the class.

### Group Meetings

Each group selects:

Duties:

Group name.

Group color.

Newspaper correspondent - - - - To give report every two weeks regarding activity of group.

Secretary - - - - - To keep accurate list of all activities.

Poster men - - - - - Direct the making of posters, securing of posters from rust agencies, and posting them.

Display committee - - - - - To prepare full display of barberry, its results, and how and why it should be destroyed. This display should be shown in the town or county fair. It might even be taken to the State Fair

### Explanation

1. Each group is to hunt common barberry bushes, spring, and summer, whenever it can.
2. Bushes are to be reported to the Office of Barberry Eradication, Box 72, Urbana, Illinois and then reported to the group secretary, who will keep a record of each person and his activities. All barberry bushes will be treated or dug by Government barberry field agents.
3. Color is for tying on barberry bushes to show others that this bush already has been treated or reported.
4. Each group captain should have a copy of this sheet.



# BLACK STEM RUST SPREADS FROM COMMON BARBERRIES



to Wheat, Oats, Barley, Rye and other Grasses.

Black Stem Rust as it appears on the leaves of the Common Barberry



Enlarged single leaf



Plump healthy grain



Shriveled rusted grain

## DANGEROUS NEIGHBORS



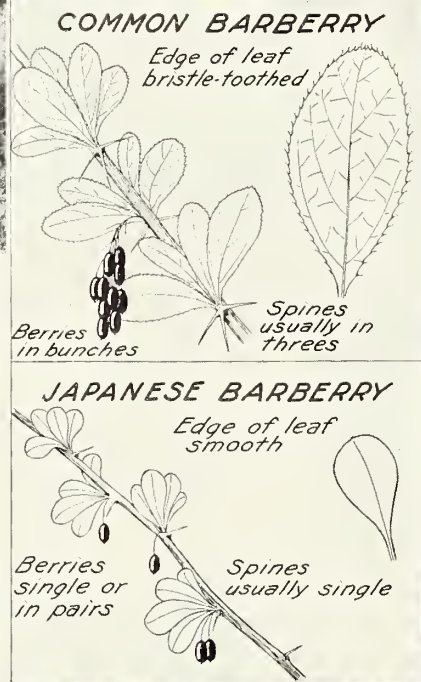
Common Barberry Bushes growing near grain fields



Report Common Barberry bushes you may find to your State Leader of Barberry Eradication.



Common Barberry is harmful, destroy



Japanese Barberry is harmless, do not destroy







FLOWERS  
(yellow)



BERRIES  
(bright red)

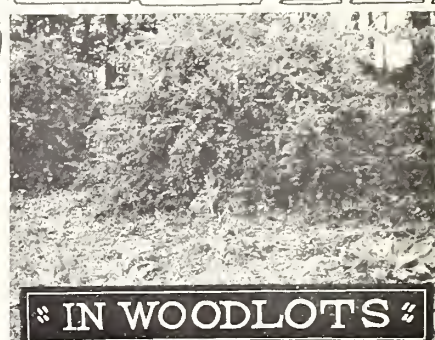
## Where Barberry Bushes Grow



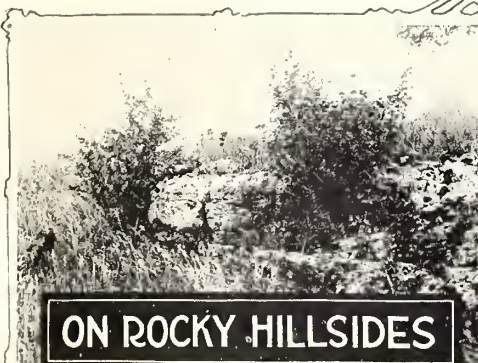
IN DOORYARDS



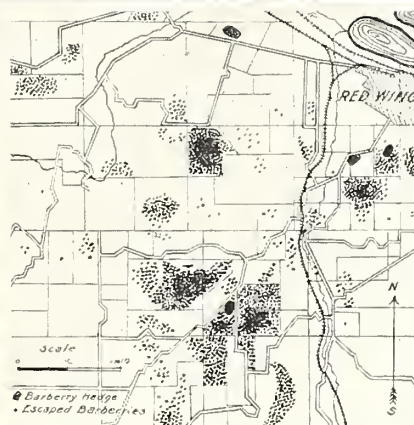
BIRDS CARRY BARBERRY SEEDS SEVERAL MILES, DROPPING THEM AMONG ROCKS AND IN OUT-OF-THE-WAY PLACES



IN WOODLOTS

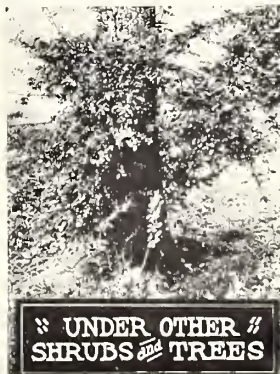


ON ROCKY HILLSIDES



AS HEDGE FENCES

Barberries spread by birds



UNDER OTHER  
SHRUBS and TREES







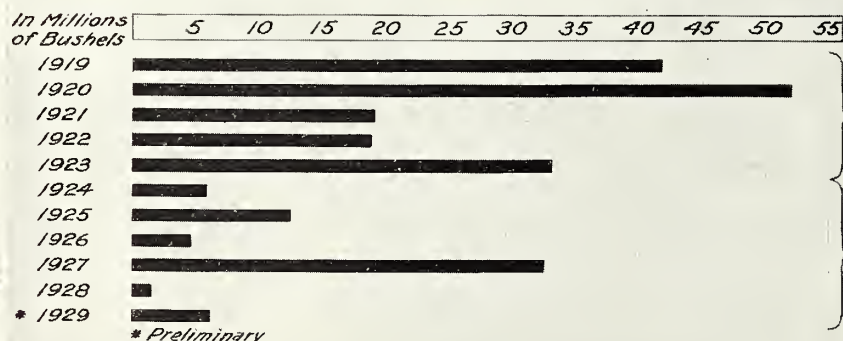
Salting a bush



Sprouts from a dug bush

## Common Salt Kills Barberry Bushes and Prevents Sprouting

### Wheat Losses in Barberry Eradication Area, 1919-1929



The average annual loss for the first five year period, 1919 to 1923, was approximately 33,000,000 bushels.

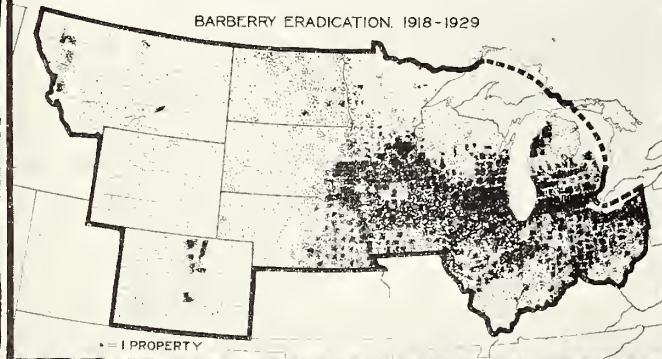
The average annual loss for the next six year period, 1924 to 1929, was approximately 10,500,000 bushels.

The losses to small grain crops caused by black stem rust have been reduced since the beginning of the barberry eradication campaign in 1918. The breeding of rust-resistant varieties, the use of early maturing varieties, and the sowing of crops early, have aided barberry eradication in this reduction.

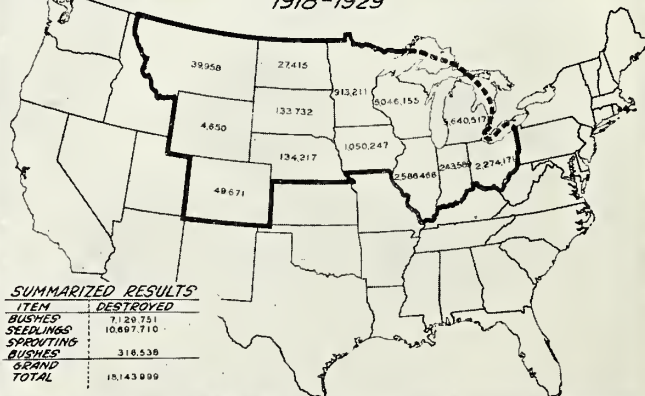
## "BARBERRY ERADICATION PAYS"

### RURAL PROPERTIES ON WHICH BARBERRY BUSHES WERE FOUND-ALL SURVEYS

BARBERRY ERADICATION, 1918-1929



### NUMBERS OF BARBERRY BUSHES AND SEEDLINGS DESTROYED 1918-1929

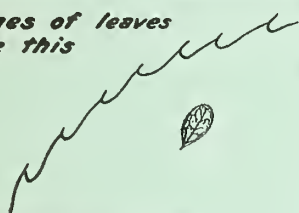


Prepared by the Rust Prevention Association, 300 Lewis Building, Minneapolis, Minn., in co-operation with Bureau of Plant Industry, U. S. Department of Agriculture, Washington, D. C.

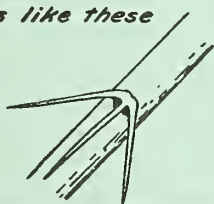
# Common Barberry Spreads Black Stem Rust

*When you find  
a spiny bush  
with-*

*Edges of leaves  
like this*



*Spines like these*



*Berries like these*



*Inner bark yellow*



*It is a  
Common Barberry  
and should be  
reported at once*

**Know  
Common  
Barberry**

***Look For It!***

*Spread of  
Barberries by  
birds*

*Birds eat the  
berries*



*Carry them to their  
roosting places*



*Where they cough  
up the seeds*



*From which seedling  
bushes grow*



*They in time  
bear fruit which  
is again carried  
farther on*

**Look For and Report All Common Barberry Bushes**

***To the Barberry Eradication Office, in care of your State Department  
of Agriculture or your State Agricultural College***

# Common Barberry Bushes

*spread*

## *Black Stem Rust*

*to*

WHEAT, OATS,  
BARLEY, RYE,  
*and* Many Wild  
Grasses

**T**HIS Study Guide is prepared and printed by the Bureau of Plant Industry, U. S. Department of Agriculture, Washington, D. C. The cover is furnished by the Conference for the Prevention of Grain Rust, 300 Lewis Building, Minneapolis, Minnesota.